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METAL FINISHING

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COMING SOON

An article on the fundamentals of hydrogen ions, their measurement in plating baths, and their significance to successful operations.

Producing antique and oxidized finishes on lead and its alloys will be the subject of an interesting article next month.

A discussion of a reliable and thoroughly practical cost-keeping system for the smaller plating shop.

Uses of abrasive blasting methods for cleaning parts for plating will be the subject of an article soon, with special consideration of its value in eliminating pickling operations.

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Contributed articles, communications, etc., on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement.

10 NEW METAL CLEANERS

from plating headquarters

In addition to the ten new cleaners announced here, a complete line of soak and electro-cleaners are available from H-VW-M. Get in the habit of asking the H-VW-M man to recommend the correct cleaners for use on each job. His knowledge of *all* phases of the electroplating process is your assurance of dependable, thorough service. Let him help you to a more efficient, more economical operation.

FOR FULL INFORMATION ON THE COMPLETE H-VW-M LINE OF CLEANERS WRITE FOR BULLETIN C-105

FOR ALUMINUM

MATAWAN #20-W. A mild cleaner with wetting agent and effective water softener. Primarily a soak cleaner... *will not etch the surface.* Excellent for zinc base die castings and bronze.

MATAWAN #20-X. A mild non-etching alkaline cleaner with cresylic base. Highly efficient for stripping paint and heavy oil films from aluminum. Very satisfactory as an extra heavy soak cleaner on soiled aluminum parts.

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STEEL, IRON (Heavy Duty)

MATAWAN #45. High-alkalinity . . . Foam free. A soak cleaner with combined forms of caustics which make it more effective on soil and grease, give it longer tank life and greater resistance to breakdown.

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TED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

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METAL FINISHING

Electropolishing and Patents

Of all the many processes in current use in the metal finishing field, electropolishing is without doubt being more intensively studied than any other at the present time. The tremendous possibilities of the process are ably pointed out in the excellent new treatise by *Dr. S. Wernick*, "Electrolytic Polishing and Bright Plating." (Available through Finishing Publications after January 1949.)

Although the principles of electropolishing have been known for many years, today's high labor costs for other methods of mechanical surface finishing have given added impetus to the application of electropolishing techniques wherever possible.

One of the complicating factors attending the use of almost all electropolishing baths is the existence of a highly confusing patent situation, whereby almost any combination of acids used could conceivably be judged to violate one patent or another. Some patent claims are so broad with respect to bath concentrations as to seem untenable under critical examination. This situation has and will continue to discourage many potential applications.

The actual bath composition is only a small part of the overall problem in applying electropolishing methods in practice; problems of temperature, current density, anode-cathode spacing, agitation, racking, and previous surface preparation are, as a whole, more difficult to standardize for any individual part. Dr. Wernick's book also gives a good insight into the many complications along these lines.

In view of this situation, we wonder if it wouldn't be wiser not to hamper the development and application of such an important process by strict insistance on patent rights. The widespread use of electropolishing which would accompany such a practice would open up new fields to producers of industrial chemicals and equipment and at the same time provide industry with a much needed solution to an ever-increasing problem.

Metal Finishing

Wishes You A Very Merry Christmas

All Our Yesterdays—Part IX

By George Spelvin

THE year is 1911. The administration of William Howard Taft, who may not have been our greatest chief executive but who was certainly the biggest, was providing the nation with a breathing spell between the more strenuous times of Roosevelt (the first) and of Wilson. Foremost in the news were the renewed troubles on the Mexican border, culminating when American citizens in Texas were killed by wild bullets from the guns of Mexican revolutionaries whose marksmanship was not equal to their enthusiasm. In January the Postal Savings system went into operation and the Senate, sensitive to its nickname of the "Rich Man's Club," passed the Constitutional amendment which provided for popular election of its members. On March 25 occurred one of the most disastrous fires in our history, the Triangle Shirt-Waist conflagration, which claimed the lives of 145 persons, almost all girls. Inadequate fire escapes and other unsafe conditions were blamed and the owners were indicted for manslaughter, but finally acquitted.

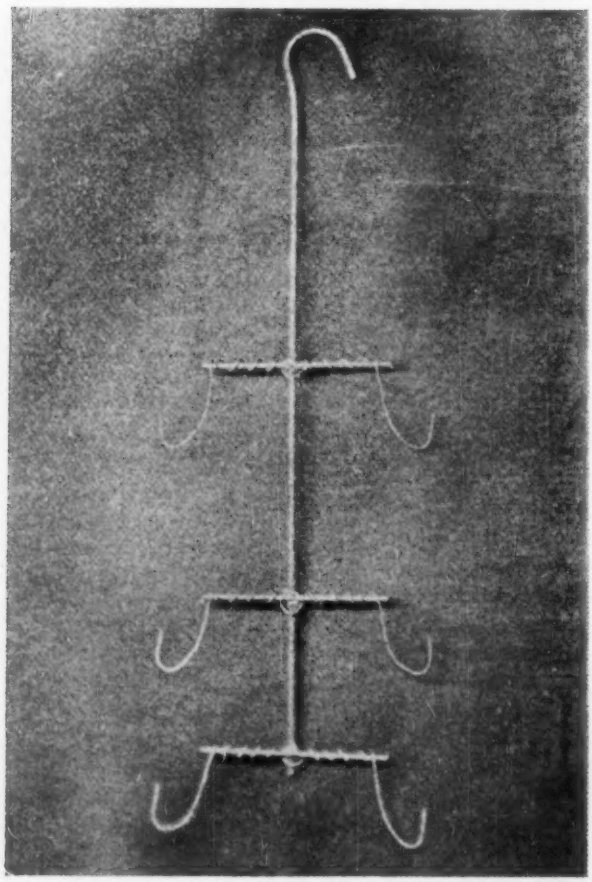


Figure 1—The simple construction of racks used in the early years of plating are in sharp contrast to today's precision and highly efficient designs. Rack coatings were unheard of at the time.

In the electroplating and allied arts it was a time for taking stock, reviewing progress and laying down possible lines for improvement. Claiming the lion's share of attention was nickel plating. We might open our bound files almost at random to an article, a helpful hint, or a polemic on the black art of putting about a half-mil of nickel on a piece of steel. Let us begin with a feature titled "Looking Backward in the Plating Industry."

"The very early history of electroplating is not particularly interesting." After this fair warning to the reader, the author reviews the aforesaid early history as far back as the Egyptians' gilding of bronze statues and coming down to Volta's invention of the battery. Continuing, "In 1840 G. R. and H. Elkington were granted the first patent for electrodepositing silver, and it is this patent that is the foundation and real beginning of our present art. It is now some seventy years since the patent was granted, and it will have to be admitted that little change has taken place since then. The Elkingtons used a cyanide solution like that now employed. Dynamos have replaced batteries, but further than this little can be said. . . . The first obstacle in silver plating was the cyanide: up to this time there was no use at all for it. It was not a commercial article and the only way was to make it. The making of cyanide was then as much a part of the plater's business as the making of the solution, and the majority of the platers who have passed the threescore mark will remember that this was so. Cyanide was then made by heating yellow prussiate of potash and carbonate of potash in an iron pot. . . .

"Let us look backward in the nickel plating industry and we will, I believe, find considerably more improvement than in the silver plating trade. . . . That nickel plating has actually arrived at a satisfactory state is evidenced by the statement of Roseleur, that eminent French electroplater, somewhere in the early seventies. He said, 'Nickel deposits in the wet way are whitish with a slightly yellow tinge, resembling the alloy for cymbals. The application is without industrial uses since nickel costs about five times as much as copper and presents the same disadvantages, in-

cluding poisonous qualities.' That Roseleur was born too early needs no argument.

"Although disputed by Gore, who says that he used the double sulphate solution for nickel plating before Dr. Adams, the actual discovery of commercial nickel plating belongs to Dr. Isaac Adams, then of Boston. . . . In the early days of the nickel plating industry Dr. Adams established his own shops, but later the demand became such that he licensed other people to use it. If my memory is right I believe that 2 cents per gallon was the royalty charged, and periodically Dr. Adams or his representative came around to collect the money. Various attempts were made to evade payment and to fight the patent, but Dr. Adams won in each instance, and the users had to pay up. I well remember that when nickel plating first became a commercial proposition, like many other newly used metals such as aluminum at the present time, it was overrated. Because of its rarity people used it as they would gold and silver. . . ."

Many other authors returned to the subject of nickel plating during the year: we find a "Review of the Nickel Plating Industry" which revisits the ground we have just covered and continues to discuss the evolution of nickel anodes. But the dam really burst with the publication of an article titled simply "Nickel Plating" which began:

"Recent progress in nickel plating has been of considerable importance, and yet this branch of the plating industry has not received as much attention as it deserves . . . there are inquiries being made continually to trade papers for information as to how certain troubles with the nickel solution can be remedied. Usually the plater sends a sample and asks why it is dark in color and states that his solution is the same as he has always used. This is the full extent of the information he gives, and he expects to be told in a few words how his trouble can be remedied. The conventional reply to such questions seems to be, 'Your solution contains too little nickel, add single salts to replenish it,' or 'Your solution is probably alkaline, neutralize with ammonia.' There are, of course, other stock answers which might do as well, but it is scarcely to be expected that the busy editor can become a mind reader, go into a trance and find out under what conditions the information seeker has produced his inferior work."

[Thirty-seven years later we still find a reluctance on the part of readers to give even the meagerest of details regarding their problems. Unfortunately for the editor, absolutely no progress has been made in the "Crystal Ball" method of diagnosis either.]

The author then proceeds to consider the advantages and disadvantages of double and single salts, and also mentions nickel fluosilicate, of which it is said, "This salt is a new one to the plating trade, and the owners of the patent have not placed it on the market commercially as yet. Its principal advantages are solubility, high conductivity, and the production of very dense lustrous deposits. . . . It is possible to obtain a bright deposit of nickel without using special imported salts, but certain precautions must be observed. The parts which are to be plated must be highly buffed and then placed in the solution and a moderate current density used." The author stresses particularly the standardization of conditions under which the work is turned out, and careful control of all steps in the process.

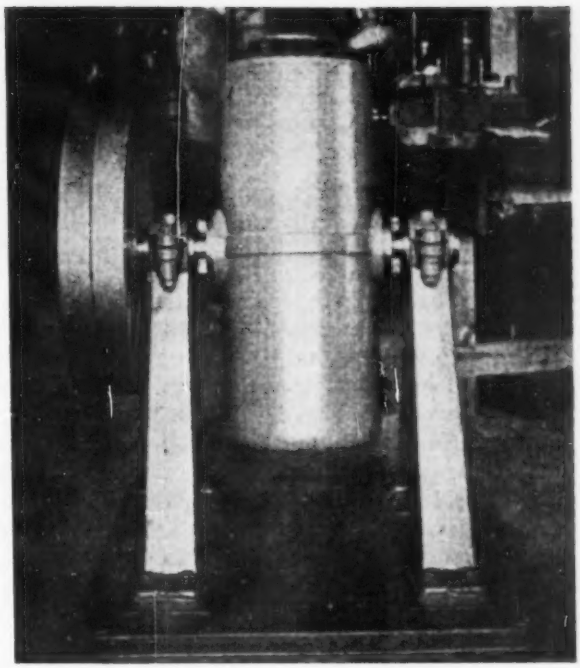


Figure 2—A totally enclosed steel burnishing and cleaning machine used extensively for small screws and bolts around 1910. Cylinder was up-ended twice during each revolution.

A reader took violent exception to some of the statements made, and thereby started a polemic in the correspondence columns which to the modern reader sometimes took on the aspect of an argument best settled in the ring. The first letter began, "I beg leave to offer a few words of comment on Mr. ———'s article on 'Nickel Plating,' appearing in the January issue. In replenishing the solution it is recommended that the single salt (nickel sulphate) should be used exclusively for the reason that the ammonium sulphate 'keeps increasing in too great a proportion' if the double salt is used. How the ammonium sulphate manages to lie dormant with arms folded and eyes shut defying the law of electrolysis is a mystery the author does not explain. Ammonium sulphate when brought into solution breaks up into its ions NH_4 and SO_4 yielding NH_3 + H at the cathode, and SO_4 at the anode." He signed the letter "Electro."

The original author replied; "Electro" answered the reply; the author responded to the answer to the reply, etc.—you get the idea. It would be interesting to quote the exchange in full, but we must content ourselves with some excerpts, high-lights from each round, as it were.

Round 2: "I read 'Electro's' comments published in the February number and I am interested in the new discoveries he has made in electro-chemistry. He can start out with a solution of nickel ammonium sulphate

Figure 3—Officers of the National Electroplaters' Society, 1911-1912. (Left-Right): C. H. Proctor, Pres.; Wm. Schneider, 1st V. P.; R. H. Slater, 2nd V. P.; H. H. Reama, Treas.; R. F. Clark, Corres. & Fin. Sec'y; Edward Faint, Rec. Sec'y.

and deposit nickel, completely regenerate his solution from the anode, decompose the ammonium sulphate into free ammonia gas, and then again decompose this into hydrogen and nitrogen, verily a most remarkable and valuable discovery. Why not bottle up the hydrogen and pick up the nitrogen that is floating around in the solution and make them commercial articles? Why not obtain capital and promote this new method of obtaining hydrogen and nitrogen as a by-product of nickel plating?

"Unless some market is found for these by-products 'Electro' will not long be a plater, if he is one, because anyone who loses the efficiency of current, such as must be lost in this case, cannot do commercial nickel plating. I can see one big objection to the pretty theory so well worked up; he generates ammonia wholesale, but his solution never becomes alkaline. This would tend to make one believe that either his test paper is in bad condition or else his theory is not a good one. . . . I must take exception to other remarks made in the same letter which states that 'It has never been made to give good results, and the writer is not aware of its being used today.' Are we to assume that because 'Electro' is not familiar with the nickel sulphate solution and does not know anyone who uses it that it is not being used? I can make affidavit that it *is* being used. It is also a strange fact that the largest chemical and plating supply houses sell large quantities of nickel sulphate, and we can safely assume that people do not buy unless they want the salts."

Round 3: "In the electrolysis of a nickel solution there is no violent decomposition with the liberation of ammonia 'wholesale.' The statement that a nickel solution 'when in good working order, there is no "gassing"' is not quite correct. There is always a slight evolution of hydrogen. Where there is no decomposition of the electrolyte no deposition can take place. Minute bubbles of hydrogen gas may be seen rising from the cathode to the surface of the bath. The hydrogen may be easily collected in a test tube by the displacement of water.

"The reactions given in my first communication are a law of electrolysis, as established by Faraday and on which all authorities agree. The happy thought of 'bottling up' the hydrogen and nitrogen, however, would not be a paying business, as the evolution is too slow.

"The weakness of Mr. ———'s excellent article is in the statement that 'all replenishing should be done with the single salts.' If the single salt is used exclusively the solution will finally reach the point where it will be impossible to obtain a white adherent deposit of ordinary weight. If any plater doubts this let him try a solution of the single salt alone for plating. The result is usually a dark muddy film which is not adherent and is of no value.

"As stated in my first communication, a sulphate of nickel solution was first described in 1842. The many plating plants that the writer has visited in the East are not using it, and the only bath recommended is the double sulphate of nickel and ammonium with only slight additions of the single salt. It is true that the supply houses sell large quantities of sulphate of nickel, but this does not prove that it is used per se for nickel plating. Many platers use it in conjunction with the double salts to stop pitting, building up solutions that have been let run down, and also for making nickel carbonate.

"It may interest your readers to know that a nickel nitrate solution was the subject of the first patent in nickel deposition granted to Joseph Shore, in England, in the year 1840. The bath was used by Roseleaur and other experimenters in the early days of electroplating. Of course, this solution is not practical and was not used to any great extent. . . . Mr. ———'s contribution closes with the statement that 'The article is the result of experiments in a practical way, combined with the reading of books and papers,' and credits Langbein 'for much of the information herein embodied.' Mr. ———'s apothegm should be made to read: 'A little experience as well as a little knowledge is a dangerous thing' when one attempts to write on such a trite subject as nickel plating." Signed "Electro."

The author got up off the canvas and returned blow for blow:

"Were all the readers of your paper chemists, or had they a general knowledge of chemistry, there would be no necessity for me to reply to the last letter from 'Electro.' Inasmuch as this is not the case I feel that I am warranted in continuing the discussion and I will try to make it brief. The question of collecting gases at the anode and cathode I will not question, as it is a laboratory experiment that can be demonstrated by anyone. I would state, however, that there is a great deal of difference between 'gassing' that can be seen with the naked eye and the form of

gassing' that can be detected by a laboratory test. Every nickel plater knows this and commences to correct the trouble when 'gassing' begins in order to prevent his deposit from being pitted.

"Any well-read man can quote references from well-known books, but it is a difficult matter to correctly interpret the references and not make them misleading. 'Electro' has used references without attention to details and they may therefore lead the uninitiated to believe that they apply to the cases at point.

"Electro's own authority states that the action of the current on the nickel ammonium sulphate tends to make it alkaline. Personally I am of the opinion that many of the old-time authors used theories that have long since been exploded and it should be borne in mind that most of the data obtained at that time was the result of laboratory experiments under conditions that are seldom met in actual commercial plating. We know positively that complete regeneration of a nickel solution from the anode is at this time commercially impossible; if it were not there would be small demand for nickel salts. . . . I could go into the theory of plating and quote many authorities, many of whom take opposite views of the same theory, but respect for the readers of your paper, lack of time, and the knowledge that it would require many pages of your paper that can be used to better advantage forbids.

"I most emphatically oppose 'Electro's' statement about nickel sulphate causing the deposit to become dark and non-adherent. Any such remark coming from a man of his position shows utter lack of knowledge of modern nickel plating as carried on in some of the most up-to-date establishments in the country. Solutions of nickel sulphate with the proper conducting salts added have been used for over three years and have never been touched except to replenish and filter. The deposit is much more rapid than in the case of the nickel ammonium sulphate solution, the appearance is brighter, the adherence as good and the cost of production less. 'Electro' loses sight of the fact that although the single sulphate costs more than the double it contains about 21 per cent of nickel while the double sulphate contains about 15 per cent.

"In closing I would suggest that your readers give careful thought to all authorities that are quoted from time to time and not take too much for granted. I would also state that no doubt most of the platers who read these articles know who 'Electro' is, and like myself would like to hear from him under his own name."

Round 5: "Let me state at the outset that my comment on Mr. ———'s original article on nickel plating was not inspired simply by a desire to rush into print, but rather to offset certain statments that I believe did not conform to the best practice. Mr. ———'s apology for continuing this discussion is particularly appropriate, for 'were all the readers of your paper chemists or had they a general knowledge of chemistry' he would have been absolutely unwarranted in sending in the communication appearing in your issue for May.

"I venture to say that 'working from the anode,' is standard practice and followed by the most skillful platers in the business. To be able to do this, however, requires years of experience and exercise of good judgment. Some platers who follow this practice do so unaware that they are working along the most approved scientific lines. Mr. ——— seems to think that under these conditions there should be 'small demand for nickel salts,' which is a particularly puerile statement to make, when as a matter of fact nickel salts are used principally to replace the solution lost in working.

"I will readily admit that it is possible to plate in a bath of nickel sulphate 'containing the proper conducting salts.' This comes very near being the same as using the double salts. But why anyone should use a bath of this nature in preference to the double sulphate of nickel and ammonium with its splendid electrolytic equilibrium is unintelligible. The strangest part of the matter is that Dr. Adams should have patented the use of the double sulphate of nickel and ammonium and carried on much litigation over said patent when equally as good results can be had by using a nickel sulphate solution and adding a little salammoniac or common salt as stated in Mr. ———'s article.

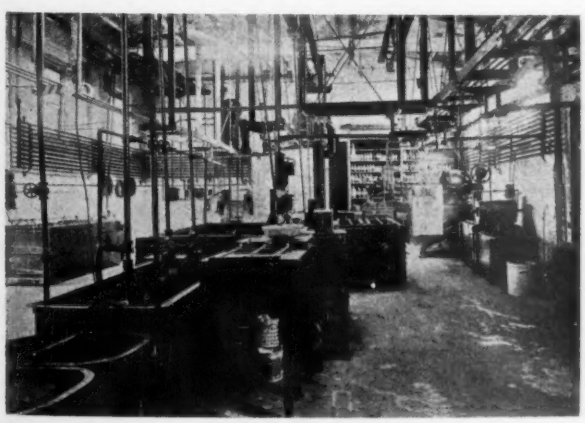


Figure 4—View of a complete plating plant set up by Hanson-Van Winkle-Munning Co. in 1911 for demonstrating procedures, etc. to customers in their Newark Plant.

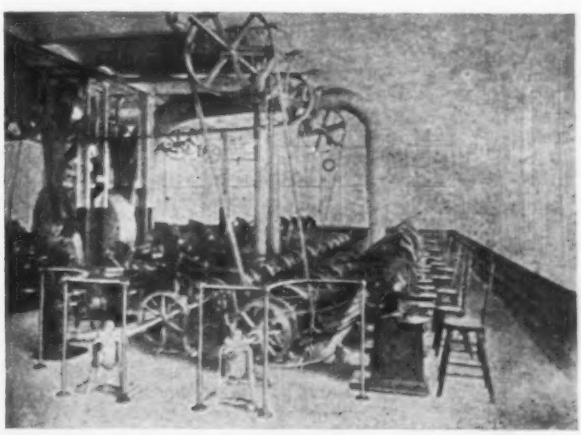


Figure 5—A "modern" polishing department, equipped with a good exhaust system. Aside from being belt operated, few differences are noted between this and today's layouts.

"I have no particular reason for withholding my name from this discussion, except that I might be accused of seeking undue publicity. As this will be my last communication I trust it will not be considered unreasonable if I sign simply,

Electro"

The original article—or to carry out our metaphor, Round 1—had appeared in January; it was not until August that the author now had the final word:

"My replies to 'Electro' have caused us to deviate from the original points that were under discussion, and I will therefore make this my last letter on the subject. 'Electro's' last letter states that in the presence of nickel sulphate any ammonium hydrate is decomposed and nickelous hydroxide would be formed. I cannot see how this is possible as the nickelous hydroxide is soluble in ammonium hydrate and if, as 'Electro' claims, the ammonium hydrate is decomposed the nickelous hydroxide, being insoluble in water, will be precipitated. Should such a reaction take place it is obvious that more nickel would be precipitated than would be replaced by the anodes and there would be an appreciable loss of nickel when the solutions are cleaned.

"It does not seem strange to me that Dr. Adams failed to see the advantages in the sulphate electrolyte. He might have patented any other double sulphate or the fluosilicate, but the fact remains that he did not and this in no way reflects on his ability. We might as well wonder why any improvement is made in electroplating, because if all the pioneers struck the proper combination and the best in every instance there would be no need for further study or research. Hall was the pioneer in the aluminum industry, but we cannot say that no progress has been made since he first obtained his patents, nor can we claim that his process has not been modified and improved upon.

"To return to the original question. (And about time, too!) In my article I urged standardization of plating conditions and gave general directions for taking care of a nickel solution, assuming that all nickel platers had not reached the stage where no troubles are ever encountered. Now 'Electro' assumes that conditions are in general well standardized, and I can only say that from the inquiries constantly appearing in trade papers, and from letters I have received, that this is decidedly not the case. Those whose conditions are so well controlled as 'Electro's' would gain but little from my paper, but it is possible that others would be benefited and it was to 'the others' that my paper was directed.

"In conclusion I would remark that all the arguments against the 'single salt' of nickel have convinced me that to the thinking man it has been clearly demonstrated that the 'double salts' have no superiority. It has been clearly shown that if the double salts are decomposed ammonium hydrate is formed. If no further action takes place there is danger of the solution becoming alkaline while the single sulphate solution is free from this objection. It has been shown that the latter salt is much more soluble than the former, also that it can be used at greater density, will stand a higher current density, and work can be plated in a shorter time. If the double salts are broken down as claimed by 'Electro,' a considerable amount of current is required to decompose the ammonium hydrate and this means lack of efficiency. . . . To my mind 'Electro' has, in speaking against the nickel sulphate electrolyte, advanced the strongest arguments in its favor, although his premise has been wrong in support of his arguments."

As we look away for a moment to the news of the national scene, we note that in April California adopted local option but Missouri and Texas defeated prohibition laws, the latter by the slim plurality of 6,000 votes out of 462,000 cast. Henry L. Stimson was appointed Secretary of War in May. The Supreme Court ordered the dissollution of the Standard Oil Company and the American Tobacco Company. On May 8 occurred the first direct telephone conversation between New York and Denver, and later in the year C. B. Rodgers made the first transcontinental air trip of 3,390 miles in 49 days, in 68 successive hops: total time in the air, 82 hours.

The National Electroplaters' Association of the United States and Canada looked back over the progress made during the past year, and found that its membership had grown to about 150 and that "the banquet and smoker that were held during 1910 were instrumental in promoting good fellowship among the members and also others who, though not members, are interested in the deposition of metals. The association has done a great deal to bring the plater 'out of his shell,' which was one of the prime objects of its formation. It can be noticed at each meeting that more members are preparing and reading papers, thus showing how the movement is taking hold and broadening the ideas of the trade at large. The recording secretary is of the opinion that the standardization of formulas and finishes should be one of the special subjects to be taken up during the coming year."

Its second annual banquet seems to have been a very successful affair. The menu bears reprinting:

MENU

French Gray Buzzard Bay Oysters
Verde Antique Olives Royal Red Radishes
Ivory Celery
Chicken Soup a la Roman Gold
Short-Circuited Bluefish
Frais de Nickel Solution
Pommes Tripoli
Electro-Cleaned Tenderloin of Beef
with Rod Connections and Cut Up Bus Bars
Punch au Potassium Cyanide
Oxidized Squab Chicken on Bronzed Tablets
Acid Green Salad
Frozen Nobilis Rings
Spray Lacquered Swabbing Sponges
Carbon Bi-Sulphide Cheese
Silver-Plated Wafers
Potassium Sulphurette Solution

One of the principal speakers at the banquet was the distinguished electrochemist, *J. W. Richards*, who once more stressed the necessity for the electroplater to make himself more familiar with the fundamental theories in physics and chemistry.

"Electroplating was directly developed by cut-and-try, rule-of-thumb methods," he said, "which resulted in practical processes being found after long years of effort and experiment. But what is now needed to supplement the experience of the practical man is clear-cut, scientific investigation of all the facts with which the electroplater has to deal. We should know as far as it is possible to know, exactly why and wherefore these processes work as they do; there is much mysterious about many of your processes and it needs the light of scientific investigation to make their workings clear.

"In this connection, let me plead for a wider field for your profession, and a wider scope for your investigations. You cannot know too much of the facts of chemistry and physics, and you can learn very much of immediate practical use in studying the other branches of electrometallurgy and electrochemistry. . . . I see among you many comparatively young men. Whenever possible, send the bright, promising young man to a college or university; let him take a general scientific or technical course. Once in a while a good blacksmith or bricklayer is spoiled by sending a man to college, but I really think that for one man that college spoils, by perhaps giving him a 'swelled head,' it probably benefits ten or a dozen."

One of the outstanding platers of that day—and this—looked over the field and pointed out those directions in which he thought the greatest room for improvement existed. His list of "unsolved problems in electroplating" is probably as good a measure as we can have of the art, and so we quote from it here. The reader may judge for himself how many of these have been taken off the list during the intervening years.

"The automobile industry has brought about, more than anything else, the need of a heavy deposit of brass. At present this is done in a solution of cyanide of copper. The deposit is not only slow, but unsatisfactory, because of what is known as 'spotting out'—a discoloration in spots which appears on the work after it has been polished and lacquered. Deposits on cast metal give the most trouble. It is probably caused by the acids or alkaline solutions being absorbed in the pores of the metal, or in the small blowholes, and the deposit covering these holes partially, leaving minute holes through which the solution oozes out. Several remedies have been suggested and tried, such as boiling out in some neutralizing chemical solution or placing in a drying oven for several days, but a satisfactory remedy has not been found.

"An acid brass solution would be a great advantage. There is an acid copper and an acid zinc solution, but no acid brass electrolyte. The difference between the deposit from a cyanide and a sulphate of copper solution well illustrates the advantage of having an acid brass solution.

"Tin.—The formula for a tin solution published by Roseleur is the most generally used today. Little, if any, improvement has been made upon it, although a good solution which would give a heavy deposit is much desired. In Roseleur's solution the electrolyte is not replenished by the anode, but by the constant addition of a concentrated solution. This should be overcome, and would be appreciated by manufacturers of tinware."

"Aluminum.—While several solutions have appeared from time to time for plating upon this metal, none of them are in general use, and a good electrolyte that would deposit gold, silver, brass or copper so that it would stand burnishing and not peel off in time could be used.

"Nickel.—The successful removal of a deposit of nickel from another metal without affecting the latter has not been accomplished.

"An electrolyte that will remove the fire-scale from brass: also one that will produce a bright or a matte surface in place of using the present acid dips.

"An electric cleaner that will saponify the grease and take it into solution instead of driving it to the top, where it has to be constantly removed to prevent it from adhering again to the work as the latter is removed from the solution.

"A heavy deposit of lead on the inside of iron pipes. to prevent rapid corrosion.

"A method to coat electrogalvanized iron or steel with decorative metals without destroying the rust-resisting properties of the zinc.

"An alkaline nickel-sliver solution that can be worked out with a low voltage.

"A method of etching steel without destroying a resistance film of gelatine.

"Some alkaline substance that would replace cyanide of potassium. This would be universally welcomed."

A novel theory of the cause and cure of spotting-out appears:

"One of the worst difficulties in plating castings is the spotting out. This is caused by the plating solution penetrating the pores of cavities in the casting. One of the common methods of overcoming it is to leave the work for a sufficient period of time to give the solution ample time to spot out as much as it will, and then finish. This cannot be used in all instances on account of the lack of time. When potassium salts are used in a plating solution they are usually the cyanide, carbonate and frequently the caustic potash. In each case, these compounds are deliquescent. Sodium salts on the other hand have the property of expelling water or drying up when exposed to the air. Sodium carbonate in crystals parts with its water when exposed to the air and becomes dry white powder. The use of sodium salts, therefore, in electroplating will bring about a different condition in the spotting out. In the case of a potassium salt which has pene-

trated a cavity during the operation of electroplating, the solution will gradually work out, and when exposed on the surface, will absorb water and gradually spread over the surface, corroding whatever portion it may touch. When sodium salts are employed in the plating solution, the solution which works out of a cavity will have a tendency to dry up and not spread like a potassium salt. While the spotting out is not entirely overcome by the use of sodium salts, it is greatly lessened. . . ."

The trials of a foreman in a job plating plant are poignantly set forth by one of them, who concludes, "Most job shops take in all kinds of work, and while one is preparing for one job, another job happens along that is wanted 'right away,' which generally requires different operations entirely; for instance. a plater may be working on gold jewelry, then it is found that some lead work is wanted, and as all jobs must be kept moving it is necessary to have some one else either finish what the first plater is doing or start the other job, and both are most important operations, being the beginning and the end. In either case, at the climax it is found that the job is not quite as you wanted and there is not time to do it over, as disappointing the customer on the time of the job is almost as detrimental as poor quality. So the plater naturally feels he will 'take a chance,' and in most cases where this happens the receiver of the goods proves to be a 'crank' on finishes.

"These are the general conditions existing in job plating shops, and, if one takes the time to investigate, he will always find those shops lacking either in quality or production on one thing or another, in fact. If one wishes to make profits in a job shop, one must take a chance, and if one desires to produce quality, one must be satisfied with small, if any, profits. Of course there are some well-regulated job shops, where more than one plater is employed under a supervising foreman, in which case each has his special class of work to produce, which alters above-mentioned conditions." Amen!

Platers had their economic as well as technical troubles, then as now, and who better as confidant than the editor of the trade journal? Listen to the plaint of one of them:

"The supply of platers, polishers, finishers, etc., increases every day, with a corresponding decrease in the number of shops to work in. What shall be done to bring back to the trade conditions that existed only a few years ago? At the present time everybody is jealous of each other's job and all are competing for the same position. The writer has looked deeply into the existing conditions and can give some facts as to the causes of this fierce competition and subsequent misery in an industry that requires hard study of all the details of the technicalities attending it, and he also offers a suggestion as to how to improve it. . . . The principal cause of the trouble existing in the finishing trades today is the head plater himself. In the average shop the plater has supervision not only over the electroplating of the work, but also over the polishing, burnishing and lacquering. This head plater is very often running what is known as a job plating shop, and he has several helpers working under him learning the business. The boss plater finds it cheaper to employ green hands and teach them the details of the business rather than to engage the services of an experienced plater, finisher, etc. After the boss plater has educated a helper to the point where he is competent to perform a certain portion, if not all the work coming into that particular shop, it usually happens that the helper will go to headquarters and solicit the position of his teacher. If this does not happen in the same shop, we find the quickly taught helper as an applicant for any open position that is being sought for by older and experienced platers. As business concerns are usually engaged in an industry for financial reasons they are naturally looking for the lowest bidder. . . . Thus the quondam helper is usually the successful applicant for the open position, leaving the experienced man in want of work.

"The writer has had actual experience in this connection. It was discovered by him that the firm employing him as a foreman plater had actually paid the expenses for a helper, working in the same shop, to attend a class at one of the technical trade schools and was being taught by an experienced plater. In due time the helper took the position of the writer, and there was then a plater out looking for a situation. The writer's solution of the problem is as follows: Let all the platers cease to teach their help, and do not allow them to help work the solutions, other than to hang the work in, unless the helper happens to be a plater himself. Stop the teaching of plating, polishing, and kindred phases of the industry at technical schools and confine the details of the trade to foremen platers alone; in other words, discourage rising young men from entering the metal finishing trade for a certain period of time. In this way the supply of platers will soon become diminished and the demand thereby increasing, the standard of wages will be raised and the trade will once more be upon a firm financial basis. The writer is aware that many will attack this suggestion, but he would like to see a discussion started and other remedies suggested.—A Plater."

The practice of filling little odds and ends of space with helpful hints to platers continued, so we find that the plater of 1911 was told to make sure his rinse waters were clean—"the use of dirty rinse water is the most frequent error in plating; that economizing on nickel anodes was unwise because metal is cheaper than salts; that it is poor practice to attempt to clean and plate in the same solution; that large amounts of boracic acid are advantageous in the operation of a nickel solution. Also, that "Cadmium is readily plated on any metal from a cyanide solution in the same manner as copper, but as yet no use has been found for such a deposit," although almost at the same time one of the first full length articles to appear in the technical press on the electrodeposition of cadmium may be noted, as this metal began to take its place in the plater's

repertory. The author concluded after numerous experiments that the cyanide solution was the best available. And we learn that "The continuous electrodeposition of two metals of the same color at the same time is a difficult matter on account of the impossibility of maintaining the necessary proportions of the two metals in the deposit. While silver and nickel may be deposited together from a cyanide solution, the proportions are continually changing and there is no method, except actual chemical analysis at very frequent intervals, of determining the proportions."

As is our custom, we conclude our survey of the lighter side of plating in 1911 with a glance at the question-and-answer columns.

Q: Is there any advantage in a heavy nickel deposit?

A: Heavy nickel deposits except in rare instances have no advantage. In fact they are unsatisfactory.

Q: How can I plate gold on aluminum?

A: First copper plate. We have never seen a job of gold plating (on aluminum) however that did not peel off. This seems to be a difficulty in plating aluminum. As far as we have been able to discover, no one has yet solved the problem.

That the place of aluminum in industry was as yet unknown is indicated by the following query:

Q: We desire to use aluminum in the manufacture of a coffee pot and wish to ask if it will be attacked by the coffee so that the user would suffer from the effects?

A: The aluminum will be slowly attacked by any liquid used in the food line, but coffee will atack it only very slowly. As aluminum salts or compounds, unless taken into the stomach in considerable quantity, are not injurious, it can be safely said that the aluminum can be used in your coffee pot without incurring any danger. There will be an extremely small quantity of aluminum dissolved. The aluminum will be slightly corroded, however, so that it will require constant cleaning and scouring.

A rose is a rose: Gertrude Stein might have been answering questions for platers in 1911:

Q: What is the theory of the use of the so-called conducting salts in plating solutions?

A: Conducting salts are used in plating solutions in order to increase the electrical conductivity. They are used in solutions which lack conductivity. When such conducting salts are employed, they allow a greater quantity of current (amperage) to pass through the solution in a given time. This means that a greater quantity of metal is deposited in a given time. If, for example, 10 amperes of current pass through the solution before the conducting salts are added, and 30 amperes pass when the conducting salts have been used, then 3 times the amount of metal is deposited per minute. Conducting salts are usually of such a nature that they do not affect the deposit nor attack the anode. In fact, they only increase the electrical conductivity of the solution.

Q: Will you kindly let us know if there is such a thing as a bright nickel solution, which will make it unnecessary to rag wheel the work after it comes from the bath?

A: A successful bright nickel solution has never been produced as far as our knowledge goes. Many operators have claimed to have produced heavy bright nickel deposits, but we have never seen them. In a properly regulated bath a bright nickel can be obtained upon polished brass, bronze, or copper, providing the articles are not plated over ten to fifteen minutes. The current must be properly regulated to accomplish this. It has been proposed to add transparent white glue to a nickel bath to produce a continuous bright deposit.

Q: Will you kindly tell me how much silver you have to put on waiter mounts to call them sterling silver mounts according to law?

A: It would not make any difference how much silver you deposited on a base metal; it would still be a silver plate and not solid sterling silver as intended by law, and cannot be stamped sterling silver. You could stamp it "solid sterling silver plate" and would not then conflict with the law. If your competitors are stamping their plated articles "sterling silver" they are liable to a fine under the new law. Sterling silver must assay 925/1000 fine. It would not be worth while plating the mounts when the ratio must be so great in proportion to the base alloy.

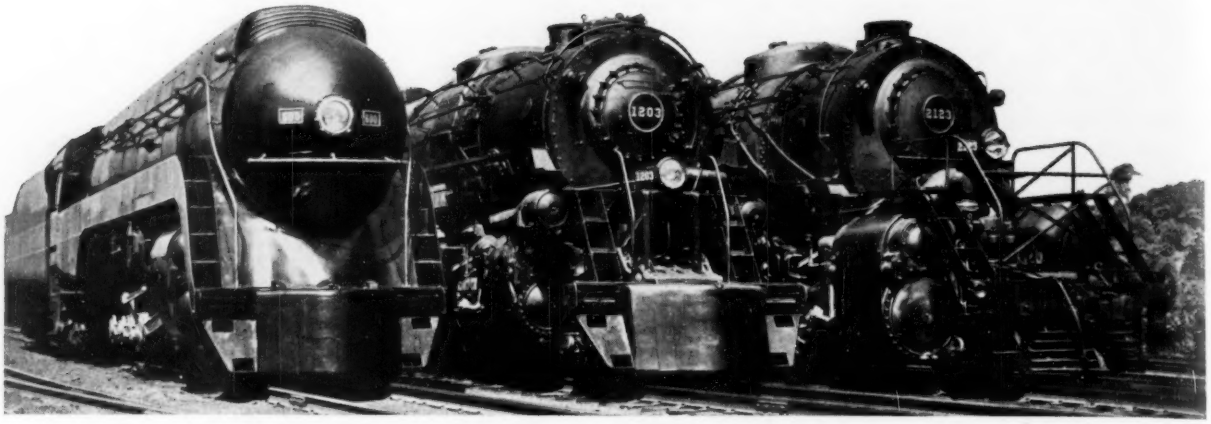
And finally, here's a reader on whom all the admonitions of the editors seem to have been wasted:

Q: Can I run a plating shop without a volt meter if I am there all the time to look after it, and how are connections made from dynamo to volt meter to tank?

A: Certainly you can run a plating department without a volt meter, providing your dynamo produced the required amount of energy. Plating rooms were run for years before the volt meter was invented, and many are now being run without them at the present time, but it is like trying to determine the time without a clock. You may guess that you are getting a sufficient voltage, but you are not sure, and as a clock will determine the correct hour, so a volt meter will determine the correct pressure in volts of your dynamo."

And so in our journey back over the past we have progressed another year toward the present, and we replace the bound volumes for 1911 on the shelf, to gather that special kind of dust which is found only in libraries. We have paid less attention than usual to the national news of the day for the reason that 1911 was a somewhat humdrum year in our country's history. There were the usual quota of strikes, lockouts and riots; New Jersey became the first state to adopt a workman's compensation law, and California gave votes to women. Joseph Pulitzer died just too early to see a story which would have delighted his journalistic heart: the confession by the MacNamara brothers of their attempt to wreck by bombing the Los Angeles TIMES building. TIME . . . marches ON.

[To Be Continued.]



Electro-Plating in a Railway Shop

By T. R. Boggess, *Gang Foreman, Roanoke Shops, Norfolk and Western Railway Co., Roanoke, Va.*

This is the second in a series of articles which show how electroplating plays an important part in essential industries other than those manufacturing a product for public consumption. Future articles will illustrate other applications of an unusual nature.—ED.

THE Norfolk and Western Railway Company has recently expanded and modernized the electroplating department in its Roanoke Shops, located in Roanoke, Virginia, in order to keep pace with the swiftly increasing demand for chromium plating used for decoration and wear resistance. Chromium plating is now the "can't-do-without" plating used in decorating the Norfolk and Western's modernized passenger and locomotive equipment. Chromium plating adds a clean-cut line to the dark surface of a locomotive, and when used in coaches with the soft pastel colors provides a contrast most pleasing to the eye.

The history of plating in the Norfolk and Western Shops began in a very small way. In the 1880's, fixtures such as lamps, basket racks, locks, etc., were all finished in polished brass or painted over, and no plating was done on these parts. The brass was cleaned and re-polished whenever necessary. The finishing plant consisted only of one buffing machine, a steam drying oven, a lacquer dip tank, a stripping tank, and a lye cleaning tank. These were housed adequately in one small room.

A small silver solution tank was added early in 1900, due to the increased number of locomotive headlight reflectors requiring plating. Later brass, copper, and nickel plating were done in small earthenware crocks. With exception of headlight reflectors, only small passenger and dining car fixtures and trimmings were replated at that time.

The increasing amount and variety of work made it

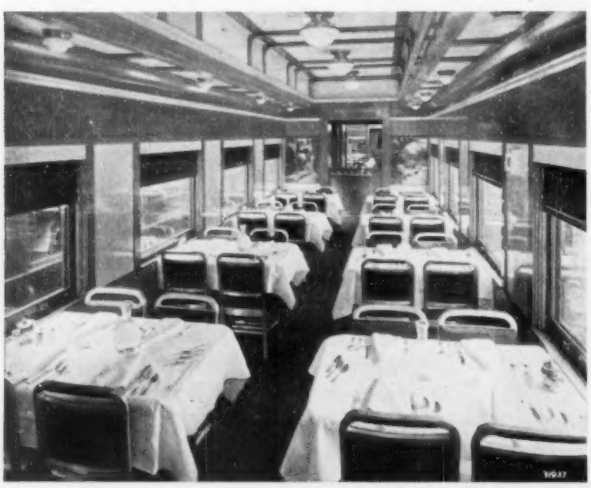


Figure 1—Interior view of Norfolk and Western Railway's standard dining car. All hardware in this car is satin chrome finish.

Figure 2—Some dining car silver, which was replated and polished at Roanoke Shops.

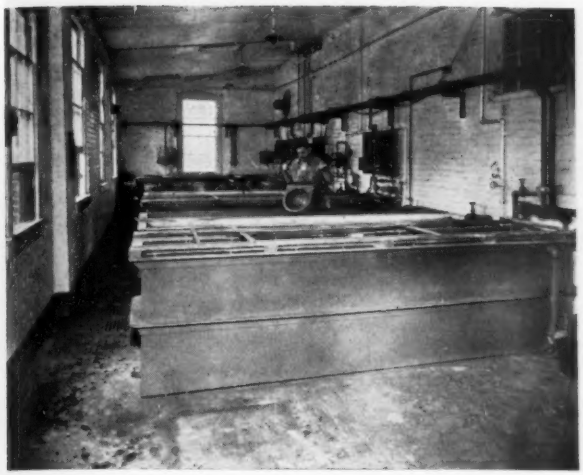


Figure 3—View of the main plating room, showing (front to rear) tanks containing alkali cleaner, cold water rinse, acid dip, cold water rinse, cyanide copper, bright copper, nickel, hot water, and cadmium. In the far end of the room are tanks containing alkali cleaner, cold water, brass, silver strike, and silver solutions. A washbasin is shown being prepared for cadmium plating.

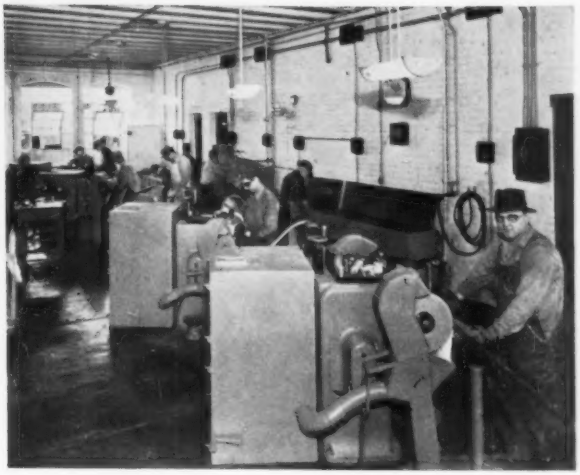


Figure 4—View of the buffing room, which is equipped with variable speed buffers. In the center of the room are shown four power-driven buffers. To the left, a workman is using a pneumatic hand buffer and preparing an eccentric crank for hard chrome. Along the right wall are sawdust bin, solvent tank, drier, and sand blast machine.

necessary to keep on enlarging and adding to the plant, and in the early 1920's a general plating room with larger tanks was added. Later on, in the 1930's, two large generators and a small chromium plating tank were installed. With this equipment, a better plate could be obtained and a larger volume of work handled, but still only small objects could be plated.

As modernization of rolling equipment continued, it became necessary to plate objects as large as locomotive main rods, which are 12 feet 7 inches long, and weigh approximately one ton.

The Norfolk and Western Plating Plant now in use consists of a general plating room, buffing room, lacquering room, hard chrome plating room, generator room over the hard chrome plating room, locker room, storage room, and an office. Seventeen men under the supervision of a foreman are required to operate the plant.

Equipment

In the general plating room are nine tanks, each tank being approximately two feet wide, three feet deep, and 12 feet long. Following the pattern of the order in which they are used, they are arranged across the room as follows: alkali cleaner, cold water, acid dip, cold water, cyanide copper, hot water, bright copper, nickel, and cadmium. This order of arrangement facilitates handling of the various pieces to be plated. In one end of this room are smaller tanks. The first is the acid dip, then follow tanks for the alkali cleaner, cold water, brass plating solution, silver strike solution, and silver plating solution. The nickel and bright copper tanks are rubber lined. Each tank containing a plating solution is equipped with individual rheostat and temperature control. All solutions in the plant are maintained and kept to standard specifications. They are analyzed and filtered periodically.

The lacquer room has a spray booth and a drying oven. Here the latest model spray guns have replaced the old hand dip method.

The hard chrome plating room has the tanks arranged in a U-shape around the room. Heavy objects are moved from tank to tank by the use of an overhead

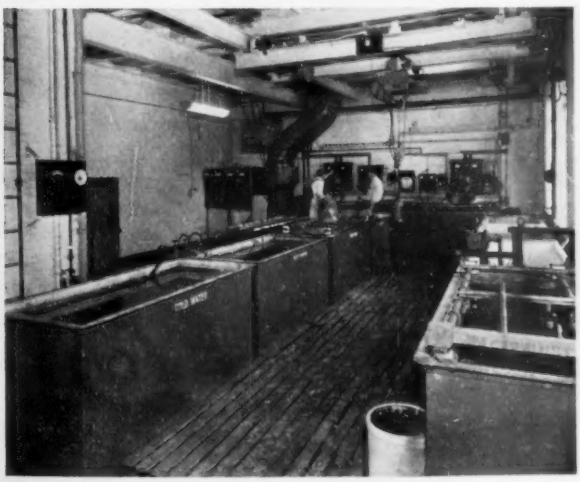


Figure 5—View of chrome plating room, showing general arrangement of tanks and overhead handling hoist for large parts.

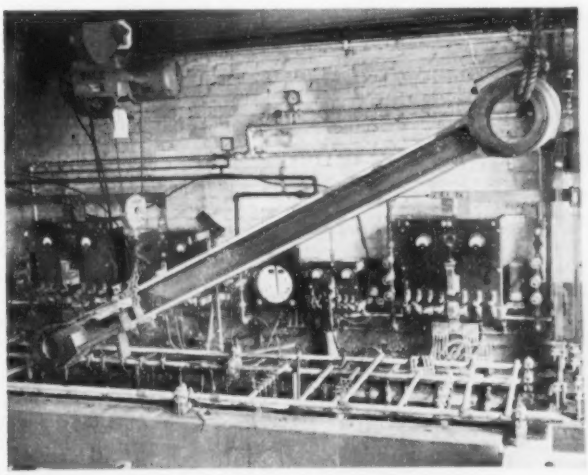


Figure 6—This photograph shows a locomotive main rod being lowered into the hard chrome tank by the overhead crane. This tank is fully automatic and plating can be done overnight to any desired thickness.

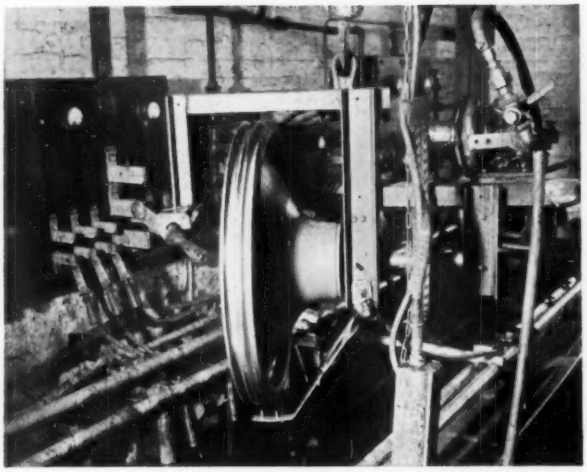


Figure 7—A locomotive piston head being plated with hard chrome. The rack holding it is equipped with an air motor, and it is revolved continuously while in the solution so as to plate evenly in the grooves, as this cannot be ground after plating.

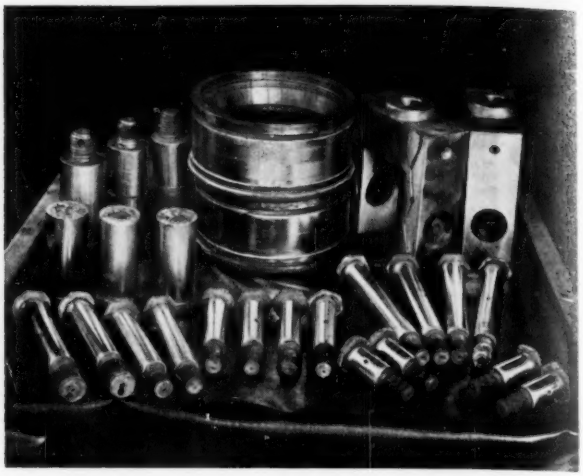


Figure 8—From left to right, in the rear, are eccentric crank pins, roller bearing cup holder, and valve stem crossheads for locomotives. In the front are passenger car truck pins. All of these parts are hard chrome plated for wear resistance.

one-ton electric crane. The tanks along the side of the room are arranged in the following order: alkali cleaner, cold water, acid dip, cold water, and at the end of the room is the hard chrome tank. After plating, the articles come back down the other side of the room, first to the reclaim tank, then to the hot water tank, the strip tank, and the cold water tank.

The tank containing the hard chrome solution is steel, coated with acid resisting material, and lined with acid resistant brick. Capacity of the tank is 740 gallons of plating solution. With a current density of 2½ amperes per square inch of plating surface and a temperature of 131 degrees F., .001" chrome is deposited in fifty minutes. When very heavy deposits are required, automatic controls permit the operation of the plant overnight without an attendant.

One feature of this tank is that it is equipped with individual panels, so that it can be set up in a bay system and five different objects plated at one time, using different current densities, without interfering with each other.

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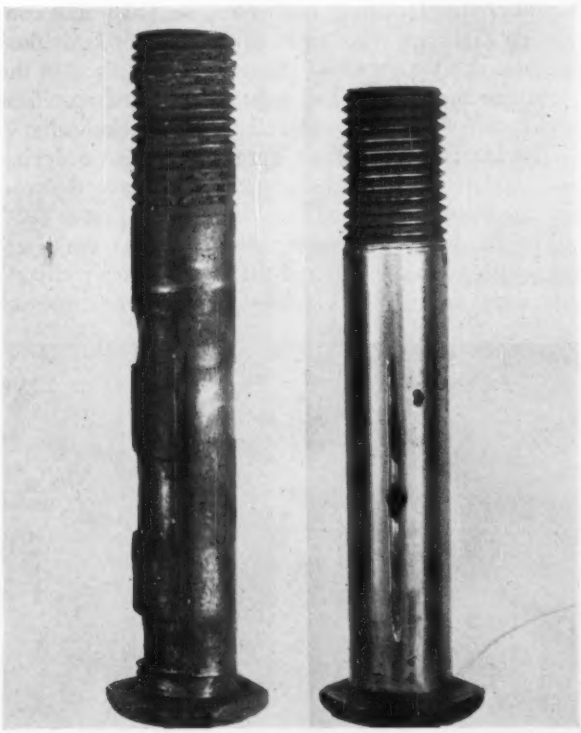

Figure 9—Passenger car truck pins. The pin at right is case hardened, hard chrome plated .016" thick, and is used without lubrication. It was in the passenger car truck for 163,000 miles before being removed in its present state. The pin at left is case hardened, but not chrome plated. It was used with lubrication for approximately the same milage as the pin above, and removed in its present state.

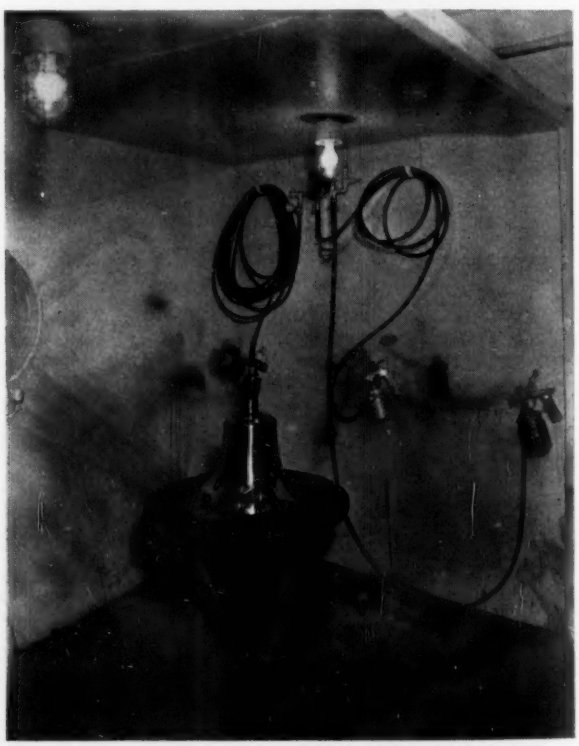

Figure 10—A locomotive bell is shown in the spray booth. The bell is of brass, and has been polished and sprayed with clear lacquer to prevent tarnishing. The lacquering department handles many other finishing jobs, involving various types of organic finishes used on the passenger cars.

Electrodeposited Zinc Coatings

By Rick Mansell, *Los Angeles, Calif.*

Introduction

THE primary purpose for applying zinc deposits upon iron and steel surfaces is to provide resistance to corrosion, rather than to reduce the mechanical wear or to improve the appearance. The durability of the zinc coatings is determined by the conditions of exposure and by the thickness and uniformity of the deposit. In those locations where the climate is dry, light coatings are sufficient to furnish protection to ferrous metals for long periods of time.

Zinc coatings are well suited to rural atmospheres; thicknesses of .0002 to .0005 inches give good protection. For really severe conditions, it is necessary to apply a thickness of .001 inch or more. The chloride content of sea air has a mild accelerating effect on the corrosion of these coatings, particularly in temperate climates. In industrial atmospheres where sulphurous gases are present, the zinc is rapidly dissolved.

An electroplated coating is composed essentially of pure zinc. Unlike those coatings deposited by hot dipping, there are no layers of alloyed iron separating it from the base metal. However, both types of zinc coating appear to demonstrate a similar degree of protection on exposure, when equal thicknesses of zinc metal are employed. When the electroplated coatings are applied to perfectly clean metal, they show very good adherence properties. Because of the good adherence, electroplated coatings are able to withstand severe bending tests and other mechanical deformation. The coatings have sufficient ductility to permit many drawing, forming, and bending operations without cracking. The absence of any incidental heat treatment in their application prevents any warping or change in temper from occurring in the steel base. The zinc electrodeposits also provide more satisfactory adhesion for paint finishes applied over them than do hot galvanized coatings.

The preeminence of zinc as a protective coating for iron and steel is the result of its characteristic resistance to atmospheric corrosion, accentuated by its electropositive nature. Because of this, the protection is extended to any of the base metal which may be exposed as a result of flaws, cracks, and pores in the coating. Cadmium is the only metal which approaches zinc in its efficiency of protection towards iron and steel. Tests conducted on the performance and cost ratios of the two coatings have indicated that for most types of exposures, zinc gives more protection per unit dollar expended than does cadmium.

For the protection of steel in industrial atmospheres, the zinc deposits are considered to be slightly superior to cadmium deposits, but they are less satisfactory under marine and tropical conditions. Since zinc is cheaper than cadmium it is employed on a much wider variety of components. It is normally inferior in appearance to cadmium, but the recently developed bright zinc coatings have remedied this deficiency. From the standpoint of corrosion resistance, there seems to be no appreciable difference between the gray zinc and the bright zinc coatings.

For all these reasons, zinc has been used to replace cadmium deposits for general protection. It is noted that zinc tends to produce a more bulky and unsightly corrosion product than does cadmium. However, recently developed passivation processes which are now being applied to zinc deposits are able to considerably enhance their resistance to corrosion, thereby enlarging their potential field of application.

Zinc plating of steel followed by passivation gives an excellent rust resistant finish. Bright zinc plating covered by a transparent lacquer is fairly cheap and effective. A further development of the method of plating zinc base die castings directly with chromium has made it possible to combine the corrosion resistance of zinc with the decorative features of chromium. The steel is plated with zinc first and then with chromium. The cost is much less than the more widely used process with copper or brass and nickel undercoatings. In order to obtain the best results, the zinc deposit should be as free from porosity as possible. For practical purposes, there seems to be no doubt that .0004 inch zinc is preferable to double the thickness of nickel as an outdoor decorative finish, if both are chromium plated.

Zinc Plating Baths

Generally speaking, electrodeposited zinc coatings are plated from either cyanide or from acid sulfate baths. In both cases the deposits are less brittle than the hot dipped coatings. These latter possess appreciable thicknesses of zinc-iron alloy layers beneath the outer pure zinc coat. In the past, thin, dull coatings have been produced at a low rate of deposition. Modern practice tends toward the rapid application of

heavy coatings using high current densities and pure electrolytes. In addition, a great deal of work has been expended on the production of thin decorative coatings of high luster and brightness.

The cyanide plating solutions have good throwing power and can be made to deposit either bright or dull coatings; the acid solutions have poor throwing power but they deposit smooth white coatings. Cleaning is more important when the acid baths are employed than with the cyanide baths, since the latter have detergent properties in themselves. The disadvantage of the cyanide baths is that they are more expensive to make up and to maintain than the acid baths. The rate of deposition is slower and the uniformity is obtained largely at the expense of speed.

The acid zinc bath is superior to the cyanide bath for the coating of gray iron or malleable iron. It has a higher plating rate and a lower cost than the cyanide bath. The acid bath has been used for a long time, and is still widely used for the plating of wire, strip steel, wire cloth and pipe, all of which do not normally require a bright finish. It is suitable for producing coatings on articles which possess a simple design similar to those enumerated, as well as for gauze and for simple steel castings. While the acid baths have a low throwing power, and tend to produce crystalline deposits, improved results can be obtained by first plating a "flash" of zinc from a cyanide bath, and then following this by a heavy deposit from the acid bath.

The cyanide baths were first introduced in 1919 and their use has grown steadily because of their improved throwing power; they are better than the acid bath for irregular shapes and for complex articles. With the cyanide bath and by the addition of the proprietary brighteners, a very attractive finish resembling chromium is produced for screws, bolts and nuts. By close chemical control, the highest cathode efficiency can be maintained. This high efficiency bath does not produce deposits of uniformly good appearance and is particularly difficult to apply to malleable or cast iron, inasmuch as they have a low hydrogen overvoltage.

Low cost steel tanks may be used for the cyanide baths. The operating current densities for general application are subject to wide variations. The composition of the bath can be varied in order to maintain good cathode efficiencies with current densities up to 100 amp. sq. ft. At this current density, deposits are produced at approximately .005 to .006 inches in thickness per hour. This speed of deposition is usually ample for production requirements, although as pointed out previously, greater speed is possible from the acid type of zinc bath.

The formulae for making the cyanide solutions are many and varied. They range from straight solutions to those containing different kinds of brightening agents, some of which are covered by patents. There are variations in the control systems used and the relative emphasis placed upon the different factors involved. A survey was made of the recommendations from various sources and these are summarized later on. The reader himself will select certain features from them to suit his individual requirements and to harmonize with his own past experience.

Surface Preparation Prior to Zinc Plating

In order to ensure that the plated coating adheres permanently, it is necessary to produce a steel surface which is not only free from oil and grease, but also has been chemically cleaned free from metallic oxides, mill scale, and corrosion products. While this is important with most types of metal platings, it is much more essential when zinc is used. Cadmium and copper do possess the ability to plate over small amounts of rust or scale and sometimes over traces of grease and smut, but when zinc is being plated such dirty areas are invariably left bare.

Drawn shapes are most difficult to clean because of the presence of compounds employed in the forming operation. Shapes which have been folded are usually more easily cleaned. Whenever possible, oils containing free fatty acids are usually favored, since saponification of the acid by the alkali cleaner assists in the rapid removal. If the drawing operation is not too severe, the so-called "soluble oils" which are emulsifiable in water are recommended. In the case of more obstinate lubricants, some method of precleaning is almost mandatory if the work is to be run through on a production schedule. An emulsion degreaser or a vapor degreaser may be used for this pre-cleaning operation.

Emulsion degreasing is able to penetrate through the grease film and to convert it into a soluble oil emulsion, which is then readily rinsed off with water. A spray rinse is considerably more effective than a submersion rinse, and should be provided, if at all feasible. Emulsion degreasers may be used full strength, or diluted with an equal volume of aromatic petroleum distillate. The immersion time depends upon type of grease, the porosity of the metal and its composition (steels alloyed with chromium are difficult to wet out thoroughly). For light films, 15 seconds is sufficient.

The process of vapor degreasing permits the handling of a large volume of work in a piece of equipment which does not require much floor space. The vaporized solvents condense on the work and dissolve off all the oil and grease. It does not remove the solid particles which are deeply entrenched in the surface. A three dip degreaser is very popular in the metal cleaning industry. Chlorinated solvents are used, and these are stabilized to prevent decomposition.

The precleaning operations are then followed by hot tank cleaning with alkaline materials, either in the still tank or by the electrocleaning process. The cleaning solution is maintained at 180 degrees F or higher. The high temperature ensures the complete saponification of the grease, and the agitation obtained near the boiling temperatures exercises a scouring action.

The efficiency of the process is greatly increased by inducing a circulation of the cleaning solution. This

removes the stagnant layer from the vicinity of the metal surface and exposes fresh solution. A further agitation is produced by the release of compressed air at the bottom of the tank; by the use of a propeller and appropriate baffles within the tank; by an external circulating pump; or more simply, by the thermosyphon effect of the natural convection currents.

If the tank is heated by a gas burner, the latter should be installed close to one end of the tank. The resulting convection currents will cause the scum on the surface of the tank to pack against the opposite wall, which should be equipped with an overflow trough which will then conduct the scum into the sewer. This prevents the scum from adhering to the surface being cleaned and leaving a dirty deposit there. If the tank is steam heated, the coil should be placed along one side and not on both sides of the tank.

The cleaning action may be further improved and speeded up, by the use of electric current. The work serves as one electric pole, and steel electrodes inserted in the tank function as the other pole. It is not good practice to use the tank itself as one of the electrodes, as this may cause a weakness of the welds and dissipates current uselessly. Separate electrodes are preferred rather than one continuous sheet. This increases the effective amount of edges available for the current to enter the solution. The electrodes should be pierced with holes to further increase the edge area.

There is a considerable difference of opinion as to whether the work to be cleaned should be made the anode or the cathode in the cleaner solution. The brass parts and zinc die casting are almost invariably cleaned cathodically. The disadvantage of cathodic cleaning is that carbon smut and metallic impurities in the bath (such as copper, iron, zinc, tin, and lead) will tend to be deposited on the metal. For these reasons, the electrocleaning tank is frequently provided with the double throw switch which permits the work to be cleaned first cathodically (to obtain the maximum gassing), and then anodically to remove any electrodeposited dirt or metals.

The current densities employed in electrocleaning usually range from 10 to 100 amperes per square foot, but these may be exceeded if all the cleaning is performed anodically. The conductivity of the bath may be increased within certain limits by using a higher concentration of the cleaning compound and by increasing the temperature of the bath. The length of the time for the direct cathodic current will be about 30 seconds but will be varied to meet the severity of the cleaning problem. However, the length of time for the reverse anodic current will be about three seconds, and except for very rough work it should not exceed five seconds.

For still tank cleaning, the solution is a standard alkali cleaner composed of four to twelve ounces per gallon of caustic soda. The stronger solutions are used for the the ferrous metals while the weaker solutions are employed for the non-ferrous components. Proprietary cleaners are composed of such alkaline ingredients as trisodium phosphate and sodium metasilicate. For electrochemical cleaning a solution composed of four ounces caustic soda and three ounces sodium cyanide per gallon can be used; alternatively, one containing, four ounces caustic soda, two ounces sodium carbonate, and two ounces trisodium phosphate per gallon. Both solutions are used at 180° F. with a current density of between 20 and 30 amperes per square foot.

If the work to be cleaned is heavily scaled or is very dirty, is is best to subject it to a sandblasting or scratch brushing operation, in order to aid the chemical cleaning processes. In many cases, hand scouring is used before the cleaning operation. This is carried out with a wet brush dipped in pumice.

At the end of the cleaning operations, the work is thoroughly rinsed. The rinse should be hot, so that the pores of the metal will be kept open to permit thorough removal of the cleaning solution. The pieces should be raised and lowered several times in the rinse and when raised should be inspected for water breaks. If the presence of breaks are noticed, the pieces should be returned to the cleaning tank.

After the metal surface has been properly cleaned, it is absolutely necessary to follow through with an acid dip to insure perfect bonding of the electroplate. In the cleaning operation, especially when it has been carried out anodically, the metal becomes passive due to the formation of a thin oxide film. This must be removed by the pickle solution.

For the pickling of iron and steel components before electroplating, a suitably inhibited solution of either hydrochloric acid or sulfuric acid is used. Sulfuric acid is used when the volume of work is large, due to its lower cost. Whenever it is necessary to remove the sand from the surface of castings, a hydrofluoric acid pickle may be used. Mixtures of between 5 and 20% of hydrochloric acid and water remove the oxide, scale, or rust from iron and steel and to some extent loosens the sand. Mixtures of between 5 and 15% hydrochloric acid and water may be operated at room temperature or at 180 degrees F. Mixtures of between 5 and 15% hydrofluoric acid are used to dissolve and remove the sand from the surface of iron and steel components.

Articles difficult to plate because of deep recesses and holes should first be pickled in the normal way and then followed by a special pickle containing 8 ounces zinc chloride, 1 gallon of hydrochloric acid and 9 gallons of water. They are thoroughly rinsed, and then dipped in the five percent alkali cyanide solution prior to the plating operation. On many occasions this system has proved to be successful after difficulty had previously been experienced in obtaining a uniform strike.

After the pickling operations, the articles are rinsed in running water so as to remove all the traces of acids used. It is also good practice to immerse the work in an alkaline solution containing 5% sodium cyanide. This provides a good foundation for the plating operation, and makes doubly certain that all traces of acids are removed. Parts then go direct from the cyanide

dip into the electroplating solution. The parts may also be kept in the cyanide dip until ready to plate, should any delay become necessary.

Cyanide Zinc Plating

The cyanide zinc solution may be used in either steel or rubber lined tanks. It is readily adapted for use either in the still tank or in the barrel plating unit. Heavy metal impurities in the bath may originate from the anodes or from copper or brass of the bus bars. They give rise to dull coatings and so should be scrupulously avoided if a bright finish is desired.

Typical solutions for still tank plating may contain:

	No. 1	No. 2
Zinc Cyanide	6.5 oz./gal.	8.0 oz./gal.
Sodium Cyanide	2.5 "	5.0 "
Caustic Soda	5.5 "	9.5 "

Both baths are worked between 60 and 90 degrees F. and the current density would be between 10 and 30 amperes per square foot. Typical solutions used for barrel plating are:

	No. 3	No. 4
Zinc Cyanide	8.0 oz./gal.	4.0 oz./gal.
Sodium Cyanide	1.0 "	9.5 "
Caustic Soda	10.0 "	9.0 "

The working temperature for barrel plating would be between 110 and 130 degrees F. The solutions are controlled by the free caustic soda content and the total cyanide contents, as well as by maintaining the ratio of cyanide to metal.

High metal and caustic soda contents have been used to increase the efficiency of the bath, and under such circumstances, current densities of 60 amps per sq. ft. can be employed successfully at temperatures between 120 and 130 degrees F. The high caustic soda types of solutions have excellent throwing power, being superior to cadmium in this respect. Such a rapid type of cyanide bath would contain 12 ozs. zinc cyanide, 4.5 ozs. sodium cyanide, and 10.5 ozs. of caustic soda. The zinc as metal is 6.75 ozs. per gal. and the total sodium cyanide is 14.5 ozs. per gal. The ratio of NaCN to Zn is 2.16. The temperature can vary between 105 and 155 degrees F. and the current density between 55 and 110 amps per sq. ft.

The solution composition is maintained within plus or minus 10% and the ratio of NaCn to Zn from 2.0 to 2.5. It is possible to operate the bath at room temperature, but at the higher temperatures of between 100 and 110 degrees F. improved current efficiencies of 90 to 95% can be obtained. In the place of the zinc cyanide, zinc oxide may be used as a source of zinc, in which case additional sodium cyanide is required to react with this oxide so as to form $Zn(CN)_2$. The oxide dissolves readily in a warm solution of sodium cyanide.

Pure zinc anodes tend to dissolve in the solution too quickly and thus to build up an excess metal concentration, which may result in rough or nodular deposits. The addition of aluminum to the zinc controls this rate of anode dissolution, helping to obtain a uniform rate of anode corrosion with little sludge formation (the aluminum is not co-deposited with the zinc).

From the chemical aspect, the cyanide plating solution consists of a mixture of the double cyanide of zinc with the formula $Zn(CN)_2 \cdot 2NaCN$, and sodium zincate Na_2ZnO_2, together with a certain amount of free caustic soda and/or free cyanide which are essential for deposition to occur. From the electrochemical aspect, the plating bath consists mainly of a solution of the complex salt, sodium zinco-cyanide $Na_2(Zn(CN)_4)$, the principal ions of which are $2Na^+$ and $(Zn(CN)_4)^=$. The anion dissociates further, but to a far less degree yielding Zn^{++} and $4(CN^-)$. Unlike the acid bath, the cyanide solution contains a comparatively small proportion of its metal content as the cation, a condition which accounts for the superior throwing power and uniformity of the deposit obtained from it. It has been established that a low ionic concentration of the principal metal promotes good throwing power and covering properties.

Bright Zinc Plating

The usual type of cyanide bath yields a bluish-grey coating. In order to produce a whiter and a more lustrous deposit, various addition agents have been added to the bath. Among these are piperonal, thiourea formaldehyde resins, gum arabic and sodium fluoride. Molybdenum is also very popular, and is added in the form of molybdic acid (MoO_3) or its salts. These addition agents have the property of increasing the throwing power and the covering power of the solutions. Deposits can be produced which approach the more expensive cadmium plating in appearance.

It is essential to maintain a high standard of purity of the solution and of the anodes. Even a slight contamination with heavy metals can cause the deposit to become darker in color and to lose its lustrous appearance. Traces of lead are very objectionable, and to a lesser extent copper and iron. Heavy metal contaminations can be removed by treatment with zinc powder at the rate of one pound per 100 gallons of solution, which precipitates the foreign metals. Alternatively, a small amount of sodium sulfide can be added. The impurities are left to settle out, but it is better to filter them off.

One of the oldest methods used to brighten the deposit was to add between .005 and .05 oz. per gallon of mercury salts, the still tank requiring smaller additions than the barrel plating method. The mercury is co-deposited with the zinc. The adverse effect of metallic impurities is much less marked than with other bright zinc deposits, because the mercury amalgamates with these impurities. The disadvantage of the use of mercury is that the coating is liable to cause season cracking in brass base metals.

Better general results are obtained by the addition of inorganic sufites and sulfides, urea, certain alcohols, and ketones, used independently or in conjunction with small amounts of molybdenum. Their use is mostly covered by patents. The metallic sheen of the coatings obtained using these addition agents is quite unlike the diffuse grey apearance of the ordinary zinc electroplate.

A solution which has been used with great success in the still tank has the following composition;

Zinc Oxide	6.0	oz./gal.
Sodium Cyanide	12.0	"
Caustic Soda	9.6	"
Molybdenum Compound	.20	"
Urea	.8	"
Sodium Thiosulfate	.4	"

The working temperature is between 60 and 90° F. and the current density between 15 and 40 amps per sq. ft. This solution has good throwing power and covering properties. At the lower current density it plates at approximately .001 inches per hour.

Although the strength of the bath may be allowed to vary, it is desirable to maintain a definite ratio between the principal constituents in order to duplicate the results. The zinc as metal may vary between 4 and 6½ ozs. per gallon; the sodium cyanide 10½-17 ozs. and the caustic soda between 8 and 13 ozs. per gal. However, the ratio of sodium cyanide to zinc is maintained at 2.6 while that of the caustic soda to the zinc is maintained at 2.0.

For barrel plating the following solution has been successfully used:

Zinc Oxide	10.0	oz./gal.
Sodium Cyanide	20.0	"
Caustic Soda	12.0	"
Molybdenum Compound	.4	"
Urea	1.6	"
Sodium Thiosulfate	.8	"

The temperature is maintained between 100 and 120° F. The content of zinc is allowed to vary between 5½ and 11 oz./gal., the sodium cyanide between 17½ and 33 oz./gal., and the caustic soda between 8½ and 17 oz./gal. However the ratio of the sodium cyanide to the zinc metal is maintained at 3.0 while that of the caustic soda to the zinc is maintained at 1.5.

Bright solutions should be analyzed frequently and the solution maintained within 5% of the recommended limits in order to get the best results. An accurate control of the NaCN/Zn ratio is very important. At temperatures between 82 and 87° F. the ratio of 2.6 is maintained while between 93 and 100 degrees F. the ratio 3.0 may be used. A low ratio of NaCN/Zn raises the bright current density range and lowers the cathode efficiency. For high cathode efficiency and good deposits the caustic soda must also be maintained in the proper concentration. Although it rarely accumulates excessively, sodium carbonate should be kept under 6 ozs. per gallon.

To improve the appearance of the bright zinc deposits, it is usual to use an after-dip, in order to eliminate the inevitable brown surface film that appears upon removing the work from the bath. A suitable dip is a solution of hydrogen peroxide acidified with a little sulfuric acid, or a solution of chromic acid containing a little sulfuric acid. Alternatively a dip in .25 to .50% of nitric acid is used. This after-dip improves the resistance to tarnish and finger stains.

Typical Proceaure jor Bright Zinc Plating of Aircraft Parts

A selection of surface preparation methods is given. Scaled or rusted ferrous metal is acid pickled; if excessive scale or rust is present, it is sandblasted. Parts are scrubbed with pumice when necessary to obtain thorough cleaning. Parts are electrocleaned and then rinsed. They are then immersed for a minimum of 30 seconds in a 2 oz. per gal. solution of sodium cyanide, immediately before plating.

To prepare the bright zinc plating solution, a cleaned tank is filled to one half capacity with tap water. Now 43 pounds of sodium cyanide and 65 pounds of sodium hydroxide are added for each 100 gallons of final solution. After these constituents have dissolved, 65 pounds of zinc cyanide are added for each 100 gallons of final solution. The tank is then filled to the required level with water. Now add with stirring, .7 to 1.9 pounds of sodium sufide ($Na_2S \cdot 9H_2O$) for each 100 gallons of final solution.

The zinc anodes are suspended from the tank bus bars into the solution, and free from contact with the tank walls. The ratio of the anode to the cathode surface should be about one to one. This ratio may be decreased when the plating area or the zinc concentration is to be decreased, or special surfaces, such as threads, are to be plated.

Small amounts of brightening agents such as those currently available, are added to increase the bright current density range and to promote a lustrous finish. The temperature of the solution is maintained within a range of normal room temperature to 104 degrees F., during the operation.

The parts are immersed in the zinc plating solution and a voltage of 1.5 to 3.5 volts is applied, depending to a certain extent on the class of the work and the distance between the anodes and the cathodes.

The parts are plated to a minimum thickness of .0005 inch except on articles having integral parts which are threaded externally, where the threads are a major portion of the article, in which case the minimum thickness shall not be less than .0002 inch. This also applied to parts whose dimensional tolerances will not permit a coating of .0005 inch.

After plating the parts are rinsed thoroughly in tap water, and are then immersed for ½ to 2 minutes in a 3-5% Chromic Acid solution at room temperature. Again they are thoroughly rinsed, then immersed for 10 to 15 seconds in a solution containing 166 pounds Sodium Dichromate $Na_2Cr_2O_7 \cdot 2H_2O$ and 10 pounds of Sulfuric Acid (66 Baume) in 100 gallons. (The pH of this solution is maintained below 1.7 by the addition of sulfuric acid.)

The parts are allowed to drain no more than 30 seconds and then rinsed thoroughly in fresh tap water, until the last rinse water shows no yellow coloration. Water at a temperature of above 100° F. should not be used in rinsing. The work is then dried with a cold compressed air-blast, or in an oven at a temperature no higher than 150° F. Drying by draining and evaporation in still air is apt to produce chalky de-

posits. The coating is soft and easily damaged until aged several hours after drying. For this reason the parts should be handled carefully and as little as possible for several hours. After drying, temperatures up to 200° F. may be used to accelerate the aging. This is the patented Cronak* process, and requires licensing for use.

Special zinc plated fluid fittings which must be identified by a black color may be dyed black after the Cronak treatment. Alternatively they may be given the Black Anozinc** treatment.

After plating, the following parts are baked for 3 hours at 375 ±25° F.:

a) Springs or other parts subject to flexure having hardness over Rockwell C-40—except hardened or carburized parts that have been tempered at temperatures less than 375° F.

b) Parts having sections less than ¼ inch thick heat treated to 180,000 psi. or over.

c) All steel bolts heat treated to 160,000 psi or over.

d) Parts which have been severely cold worked (roll-threaded) after heat treatment, with a hardness of Rockwell C-25 or over.

Passivation of Zinc Coatings

There is a tendency for zinc deposits to corrode in a damp atmosphere, and to become coated with a white deposit. To prevent this, the zinc surface is passivated. The original procedure was to immerse the plated parts in a 5% solution of Chromic Acid for 15 to 30 seconds, immediately after rinsing. The solution was contained in an earthenware or glass tank and was used at room temperature or up to 180° F. The Chromic Acid produces an oxide skin which is impervious to the atmosphere. In addition to passivating the coating, the chromic acid dip neutralizes any remaining sodium cyanide and caustic soda from the plating solution and also brightens the plate. Other bright dipping materials, such as nitric acid, sulfuric acid, and peroxide solutions tend to decrease the corrosion resistance. After the chromic acid dip the parts are immersed in water at 180-200° F. This rinse removes traces of chromic acid and yields a hot clean surface which will dry readily in air.

More recent development have resulted in the improvement of the passivation process by different methods. Two important chromate treatments are the Iridite treatment† and the Cronak Process.†† Two anodizing processes are Yellow Anozinc and the Black Anozinc.††† Another passivating dip is the Luster-on process.††††

The chromate solutions are acidic in nature and they produce a skin of superior protective value. The immersion time is reduced to a minimum so as not to remove any of the plated coating. The Cronak process has already been described.

Before the parts are dipped in the Iridite solution, they are immersed in an acid rinse which is maintained at a pH value of 4.0-6.8 with either chromic acid or nitric acid. They are then transferred to the bath which is operated at a pH of 1.67-3.5 and at a temperature of 75-100° F. The mildly agitated zinc plated parts are dipped in the solution until a uniform olive drab coating is obtained. If the time to obtain a satisfactory coating exceeds 45 seconds, additions have to be made to the solution. The treated parts are then subjected to an acid rinse maintained at a pH value of 4.0-6.8 with chromic acid or nitric acid. The parts are then rinsed in hot water 160-180° F. and then dried. They are not handled until the surface coating is perfectly hardened. Very thorough washing of all types of zinc deposits is essential to prevent the plate from developing stains and discoloration. The treated surface presents an excellent paint or lacquer base.

In the Anozinc process, the zinc plating is first rinsed in cold and then in hot water. It is then anodized in the Anozinc bath at 5-20 amps sq. ft. for 1-5 minutes, rinsed in cold water, then soaked in a boiling hot sealing bath for 10 to 15 minutes. It is then rinsed in cold and hot water and allowed to dry. The process has been used for refrigerator shelves and provides a coating having great resistance to corrosion.

Under normal circumstances, zinc plated parts will not stand over 24 hours in the salt spray cabinet without developing white corrosion products and then deteriorating. However, after they are passivated, they are able to withstand over 500 hours exposure.

Acid Zinc Plating

The acid bath is more readily applicable to deposition on cast iron. Furthermore, when zinc is plated from a cyanide bath, there is the liability of severe embrittlement, particularly with thin sections composed of steel of high carbon content. When acid plating is employed there is much less danger of such hydrogen embrittlement.

The electrolyte consists of acid solutions of zinc sulfate used at between 32 and 48 ounces per gallon. Sulfuric acid is added to adjust the pH to between 3.5 and 4.5 for still tank plating; high pH values, above 5.0, are used for barrel plating. The conductivity of the solution is increased as the higher acid values are used, but then the efficiency begins to fall.

The acid in the electrolyte tends to dissolve the zinc anodes and this causes the pH value to rise steadily. At the same time the basic zinc salts deposit at the anodes, so that the rate of attack gradually decreases. For these reasons, there is a gradual increase in metal content of the bath (unless too much is lost by drag-out) while sulfuric acid must be added from time to time, to keep the pH value within the optimum working limits.

The chlorides of sodium, aluminum, and ammonium are often added to increase the conductivity of the solution, especially when barrel plating is carried out. It is necessary to avoid an excess of these salts, so as

* *New Jersey Zinc Co.*
** *Patented by United Chromium, Inc.*
† *Patented—Allied Research Products, Inc.*
†† *Patented—New Jersey Zinc Co.*
††† *United Chromium, Inc.*
†††† *Chemical Corp.*

to prevent an adverse effect on the appearance of the deposits and upon their corrosion resistance.

Organic addition agents are often added to the acid bath so as to improve the smoothness and the lustre of the deposits and to enable increased current densities to be employed without leading to the formation of coarse grained coatings. Certain of these addition agents also help to reduce the tendency of the anodes to dissolve in the slightly acid solutions. Among the organic addition agents used are gelatin, dextrin, sulfonated cresols, alcohols and glycerin.

Acid solutions are best operated in rubber or lead lined steel tanks, ceramic, or moulded synthetic resin tanks. The heating or cooling coils can be of hard rubber or lead covered steel. A typical solution for the still tank is:

Zinc Sulfate	32 oz./gal.
Ammonium Chloride	2 "
Aluminum Sulfate	4 "

A typical barrel plating solution has 64 ounces of zinc sulfate and 2½ ounces aluminum chloride.

Acid solutions for still tank plating are operated at room temperatures, because when the temperature exceeds 90° F. the deposits tend to become darker and coarse grained. As a general rule the throwing power is not too good, and adequate covering of deeply recessed articles can be procured by first plating from a cyanide solution. The usual range of current densities is between 20 and 40 amperes per square foot. However current densities of 1000 amperes per square foot have been used for the zinc plating of wire.

In the last decade there has been the introduction of continuous electrogalvanizing instead of the hot dip method for the production of zinc coated steel wire. The disadvantage of the hot dip process is that brittle alloy layers are formed between the zinc coating and the ferrous metal base, resulting in a deposit liable to peeling when the wire was subjected to excessive deformation.

In the continuous process inert anodes of lead-silver alloy are used, and so the electrolyte is more acid than that employed in the usual still tank plating. The electrolyte consists of 70 grams per liter of zinc and up to 250 grams per liter of sulfuric acid.

The wire is first annealed at 700° C. in a lead bath and then carefully cleaned, either cathodically in molten caustic soda or in a solution of caustic alkali.. It is next anodically etched in a tank filled with the highly acid spent electrolyte. It then passes through a strike solution containing about 150 grams of zinc per liter and is then conducted through the main plating cells. These are 100 feet long and the electrolyte is circulated continuously through them. They are made of lead lined steel and are water cooled to prevent the excessive temperature from developing.

The current densities may vary between 800 and 2000 amperes per square foot depending upon the size of wire being coated. As the deposition of the metal proceeds and the metal is depleted from the electrolyte, the acidity increases considerably.

The deposit is of a very high purity, close to 99.99% and is so ductile that the finished wire can be wrapped around its own diameter without fracturing the coating or loosening it from the steel. Thicknesses up to 2 ounces per square foot are regularly deposited. The purity of the electrolyte is important. Another application for continuous electrogalvanizing is in the plating of steel strip.

Fluoborate Zinc Baths

The introduction of metal fluoborate baths has enabled improvements to be achieved, both in the high speed continuous baths and in the still tank applications They operate at room temperature with a high cathode and anode efficiency. Coatings may be deposited on cast or malleable iron to give good adhesion, uniform coverage and an attractive light-colored finish.

For high speed plating as is required in wire, strip or sheet application, the following type of bath is used:

Zinc fluoborate, $Zn(BF_4)_2$	40.2 oz./gal.
Ammonium chloride	3.6 "
Ammonium fluoborate, NH_4BF_4	4.7 "
Licorice, 1 gm per liter or	.134 "

The bath may be made more dilute for tank and barrel plating. A pH range of 3.5 to 4.0 is maintained. The optimum operating temperatures range from 80 to 130° F. The lower temperatures increase the throwing power, while the higher temperatures reduce the resistance of the bath. For high speed plating, temperatures in the region of 130° F are therefore recommended.

Licorice is preferable in high speed plating because of its lower resistance, but Karo is preferred for low current density plating, as it improves the covering power and gives smoother, finer-grained deposits. For best results in high speed plating, the anode area should be about equal to the cathode area and larger if possible. For tank plating, the anode area should be twice the cathode area.

Chromizing Steel Surfaces—Applications

By Edward Rosen and George Black, *New York City*

IN THE August issue of *Metal Finishing*, the authors discussed the history and development of chromizing, a process defined as a means for producing on the surface of steel parts an integral layer rich in chromium. Although typical uses and applications of the process were listed, we were unable to obtain photographs in time for publication. The illustrations (I through IV) shown below clearly indicate the variety of applications used successfully by the German war machine. In addition, we have also been able to obtain photographs of various parts chromized in England. (Figures V and VI).

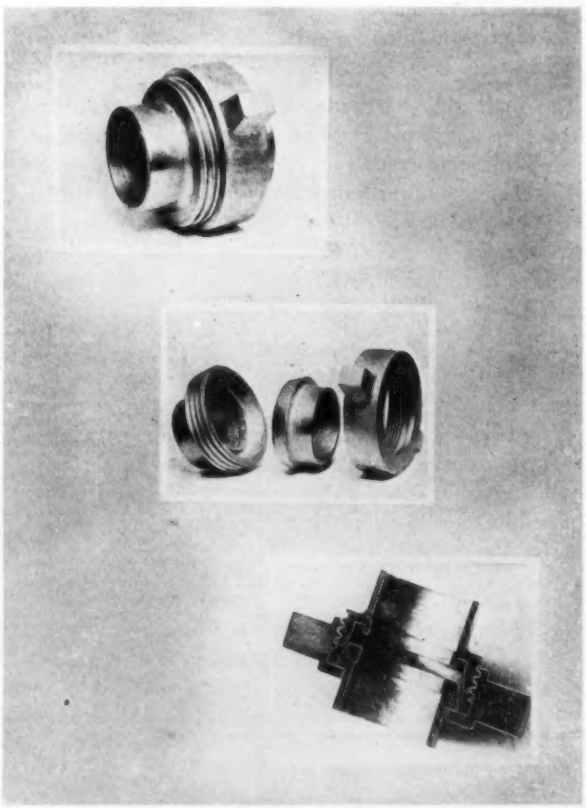

Figure I—Various parts of a coupling which have been chromized. The cross sectional view shows clearly how the coating protects mating surfaces.

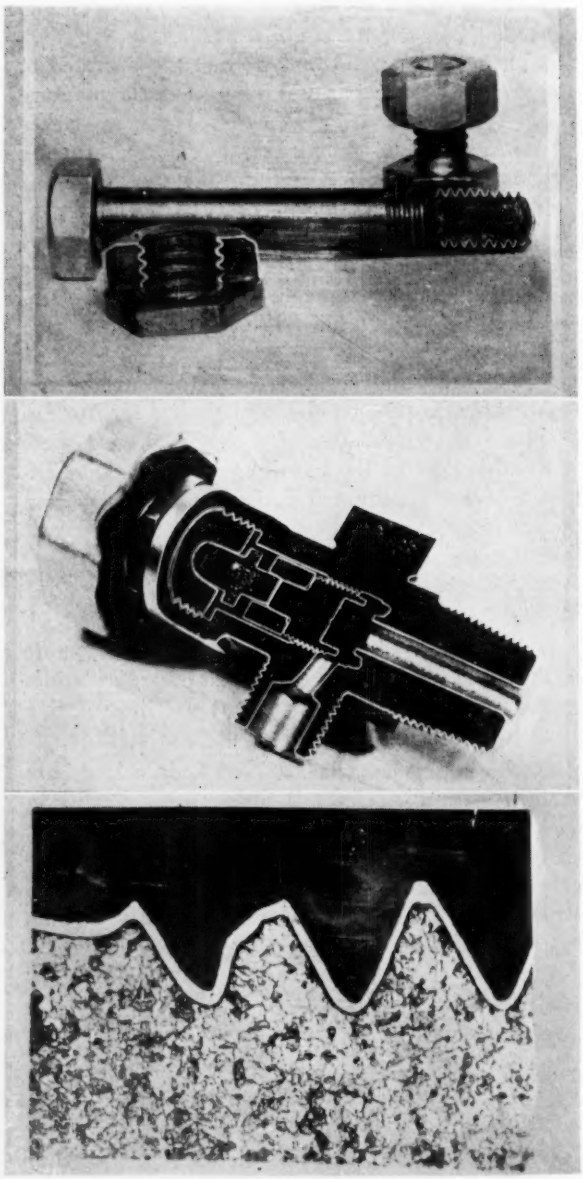

Figure II—Various threaded parts, including a nut, bolt, hollow bolt assembly and a photomicrograph showing the layer formed by chromizing.

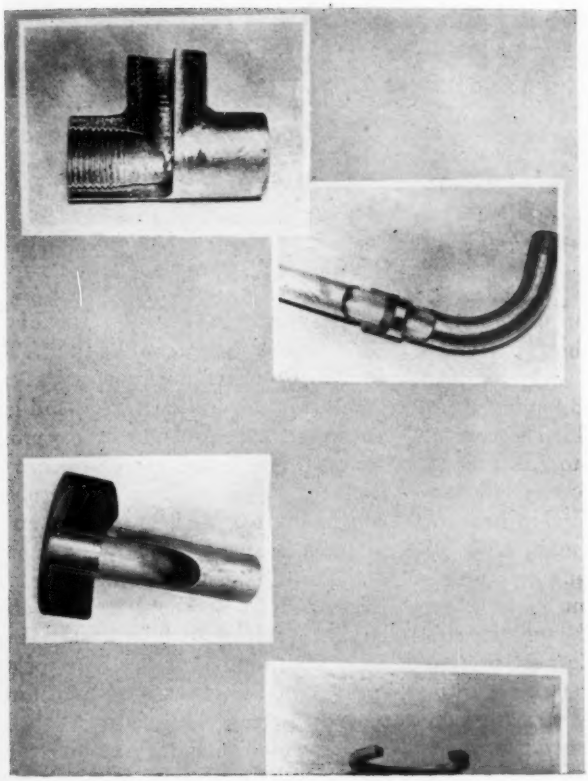

Figure III—Cross sectional view of a "T" fitting, a tube coupling assembly, and a press fitted tube, all chromized.

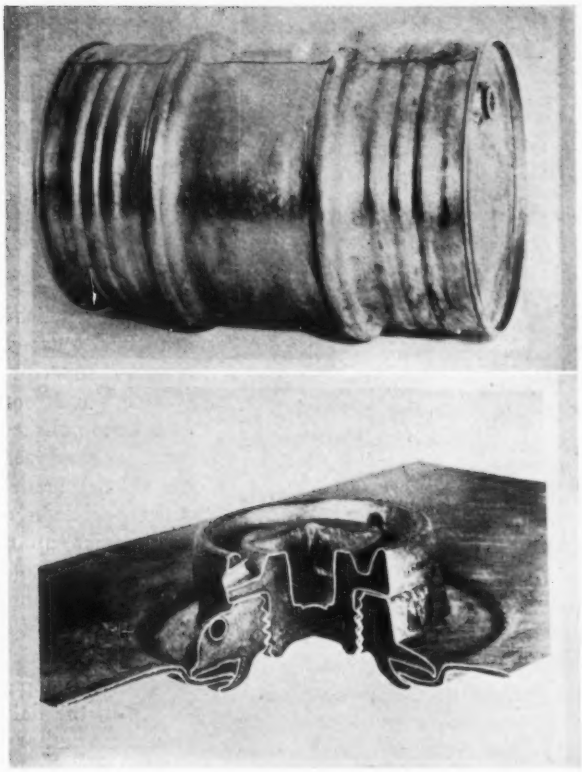

Figure IV—Barrel made of chromized sheet, cutaway view of bottom shows chromized threaded surfaces.

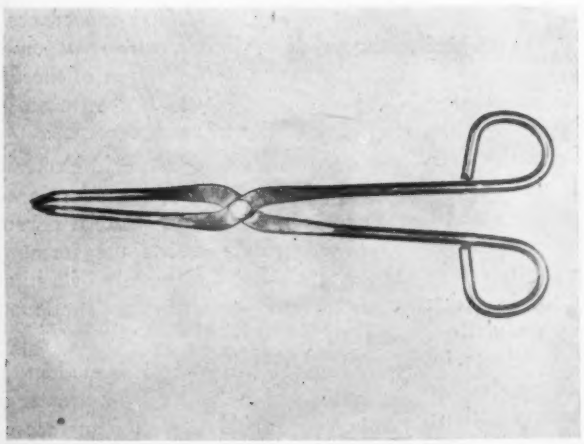

Figure V—Laboratory tongs must withstand severe corrosive conditions, as well as occasional exposure to high temperatures. Chromizing such articles helps maintain them in good working condition for long periods of time.

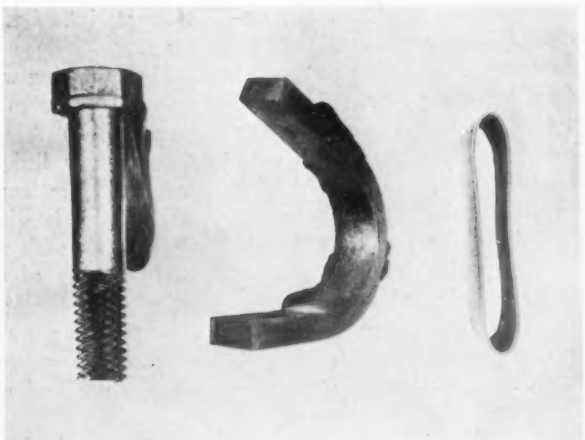

Figure VI—The bolt at the left has had its thread partly ground away and then etched so that the chromium layer stands out as a thin white coating. The bent bar illustrates the ductility which can be obtained in a chromized part. The third, at right, illustration is of a chomized tube in which the steel inner layer has been partly removed by acid and the chromium coatings of the interior and exterior flattened to show their ductility. (English test).

Electrolytic Polishing of Brass Pressings

By P. Berger, *Chief Chemist, Wm. Bate Ltd., Walsall, Eng.*

Introduction

THIS paper deals with a process for the electrolytic polishing of brass pressings and with the industrial application of the process. The shortage of polishing labor, machines, mops and abrasives is particularly serious for the jobbing plater who has to cater for a variety of articles. In large job plating establishments, the available polishing machinery is used for large steel and brass articles, and zinc base die castings, while barrel polishing methods can be used for most small steel or brass articles. Brass pressings, because of their shape and the ease with which they can be indented, are not suitable for barrel polishing, and therefore electrolytic methods have been explored.

Preliminary Investigations

A survey of the patent literature on the subject disclosed three main types of process for the electrolytic polishing of brass: (1) a phosphoric acid process, (2) a chromic acid process, (3) a process employing a mixture of phosphoric, sulphuric and arsenic acids. These processes were tested and found to give the following results: (1) the plain phosphoric acid was satisfactory only at low temperatures which were impracticable owing to the heating effect of the current. The electrolyte showed very poor current distribution, and was useless for intricate shapes, and the surface stained badly on exposure to the atmosphere. (2) The chromic acid process, using an electrolyte containing chromium trioxide, sulphuric acid and other addition agents gave good current distribution, and elaborate temperature controls were unnecessary. The surfaces did not stain after polishing, but the principal draw-back was that the finish was scarcely superior to a bright-dipped surface, and compared unfavorably with hand-polished work. The current densities employed (up to 2,000 amps. per sq. ft.) made the process uneconomical, while a considerable time of electrolysis (up to 60 min., with an average of 12 to 30 min.) was necessary. The amount of metal removed was excessive. (3) Although the sulphuric-phosphoric-arsenic acid process has been developed by an eminent authority in the field of electrolytic polishing, the author failed to achieve any satisfactory results in the application of the process as described in the specification which was then available. This implies no reflection on the process, but merely that the author's attempts at reproducing the results were negative in that instance.

In view of these trials it was decided to attempt a fresh line of research. As the articles in question were made of single-phase copper-zinc alloys, the investigations were limited to this type of material, *i.e.*, "yellow" (alpha) brass.

The following were considered to be essential features of a satisfactory process: (*i*) A smooth finish which should show little or no undulation, and therefore compare satisfactorily with that of hand-polished specimens; (*ii*) a fairly wide range of application; (*iii*) rapidity of treatment; (*iv*) stability of the electrolyte; (*v*) power consumption not excessive; (*vi*) a fair range of operating conditions such as temperature and current density.

Theoretical Considerations

Electrolytic polishing depends mainly upon the efficient creation of certain anode phenomena. Within certain current density limits a viscous film is formed in immediate proximity to the anode surface, and this film offers a greater resistance to the flow of the current than the electrolyte itself. This insulating effect is greatest at the crevices in the anode surface, and least at the surface protrusions or prominences. The latter, therefore, are selectively attacked during electrolysis, and finally removed, so that the anode surfaces become progressively smoother. Perfect insulation occurs at no point, and thus a slight faceting effect becomes evident, which results in a very high optical reflectivity of the surface, at the expense of undistorted reproduction of the image.

This anodic film may be either (1) predominantly gaseous or (2) mainly composed of viscous layers of electrolyte highly saturated with anode dissolution products. Both these constituents of the film are always present, and there is usually a polarization effect as well. The final appearance of the anode surface is entirely dependent on the extent of formation of the film, the character of which determines the quality of the whole process.

An ortho-phosphoric acid electrolyte results in an anodic film predominantly gaseous in character, while a chromic acid electrolyte assists the formation of a film consisting mainly of a highly concentrated solution of anode material.

From the foregoing it is evident that a gaseous film will afford greater insulation, and therefore the surface will be smoother. Reflectivity will deteriorate, but the reproduction of images will be truer. Very little metal will be removed (a high rate of gas evolution shows low electrode-dissolution efficiency, and the insulation is great), and treatment will be lengthy. This is borne out by the fact that a phosphoric acid electrolyte gives rise to all these phenomena. The reverse is true of an electrolyte forming a predominantly liquid film, with the possible exception of time of treatment, as the rapid rate

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of overall anode dissolution may increase the time required for obtaining a smooth finish.

An important conclusion from this is that the character of the anode finish may be most easily controlled when the anodic film is predominantly liquid, while control of finish on an anode covered by a gaseous layer is virtually impossible. On the other hand the finish obtained by employing a gaseous film is less liable to variations than is the case with a liquid film, but the careful study of anode phenomena minimizes the risk of critical variations in this respect.

It is also evident that an electrolyte forming a liquid film will be more limited in its application to metals of varying alloy-composition than a solution forming a predominantly gaseous layer. The reason is that the film in the former case consists mainly of anode-dissolution products, so that constituents in the anode material which are less soluble in the electrolyte will have a profound effect on the insulating properties of the film. Thus it is very difficult to polish brasses containing a significant proportion of lead in a chromic acid electrolyte, as the chromate of lead is insoluble, and the viscosity of the film is therefore greatly reduced.

Having regard for all these points, it was decided that for the purpose in question a compromise had to be reached on the relative merits of each type of electrolyte, and it was decided to formulate an electrolyte which should have the following properties:

(1) The anode film formed should show a slight predominance of liquid, and should be formed at a point where polarization would be only incipient, in order to prevent stains due to uneven distribution of the polarization film, the presence of which was, however, found desirable to some degree.

(2) The ratio of gas to liquid in the film should be variable if desired, in order to deal with a variety of initial anode-surface conditions.

(3) The electrolyte should possess high conductivity, and good current distribution; in order that the film should be formed all over the anode surface, even when of intricate shape.

(4) The electrolyte should be a very good solvent of the anode, thus allowing a large amount of anode material to be kept in solution and increasing the working life of the bath.

Research Progress

In order to fulfil condition (1) an electrolyte was devised containing both orthophosphoric acid and chromium trioxide. It was found that two distinct types of electrolytes were feasible, depending on the type of work in hand: (*a*) A bath in which the weight to weight ratio of H_3PO_4/CrO_3 was greater than 10/1, and (*b*) a bath in which that ratio was less than 1.5/1. The latter solution was found to be more suitable for rapid work on fairly rough surfaces, and was therefore adopted as a basis. Considerable dilution with water was necessary in order to improve results.

This electrolyte, however, had many disadvantages. Its ability to keep anode material in solution was low, and current distribution was not satisfactory. Another drawback was that an appreciable proportion of the chromic acid was converted into the trivalent compound by electro-chemical reduction, but, on the whole, the results were encouraging. Working with an electrode distance of 7 in., at a temperature of 75° F., good results were achieved with this type of electrolyte, and the current density range was between 250 and 1,250 amps. per sq. ft. When freshly prepared, the solution showed excellent conductivity, giving a current density of 250 amps, per sq. ft. at a pressure of only 7 volts, but after some use the voltage had to be increased to as much as 24 in order to maintain the current. This was mainly attributed to rapid saturation with electro-chemically reduced chromic acid. To overcome these defects it was decided to adopt the mixture of phosphoric and chromic acids as a basic electrolyte, and to investigate the possibility of using addition agents to render the process more practical.

The main drawback was considered to be the poor solvent properties and rapid reduction of the chromic acid. The chromic acid content could not be increased indefinitely, the maximum permissible concentration being at that time about 350 to 400 gms. per litre. Nor was it desirable to increase the phosphoric acid content, as a ratio of H_3PO_4/CrO_3 in excess of 1.5/1 resulted in a very poor finish until the weight to weight ratio of 10/1 was reached, when the process again became successful. Then, however, the current distribution suffered, and treatment was very lengthy, as the anodic film became mainly gaseous. (*N.B.*—The effect of water and the optimum rate of dilution, and data relevant to these, were also carefully ascertained.)

At this stage the basic electrolyte which will, for brevity's sake, be refered to as "Basic Electrolyte A," was composed of: Water, 65 to 91 per cent by weight; orthophosphoric acid, S.G. 1.75, 35 to 9 per cent by weight; chromium trioxide, 385 gms. per litre of the mixture.

Addition Agents

It was found necessary to provide an addition agent which would allow a greater amount of anode material to be kept in solution, and a means had to be devised to prevent, retard, or compensate for, the reduction of the chromic acid. The first problem presented few difficulties, as any strong oxidizing agent which would not seriously affect the finish would serve the purpose. The second problem, however, was thought to present greater difficulties, as the electro-chemical reduction of the chromic acid could obviously not be avoided, nor did there seem any possibility of retarding the action and still allowing the electrolyte to do its work. It was, however, decided to employ potassium dichromate as the oxidizing agent for the first purpose, and on electrolyzing the basic solution "A," containing a further 70 gms. per litre of $K_2Cr_2O_7$, a marked improvement was evident in both respects. Further study revealed that during electrolysis a number of complex reactions took place, and although their exact nature could not be ascertained, the results achieved seemed to bear out a theory along the following lines:—

The chromic and phosphoric acids exert the anodic attack upon the anode material, which goes into solution as the chromate, the incipient phosphates being rapidly converted, as there is an appreciable amount of water present in which they are not soluble. The potassium dichromate appears to fulfil three functions; it splits up, and by its oxidizing action ensures the complete dissolution of anode material as the chromate. It also reacts with the hydrogen evolved at the cathode; this exerts its reducing effect on both the CrO_3 and the $K_2Cr_2O_7$, thus retarding the total reduction of the CrO_3, which latter substance therefore achieves a longer working life within the electrolyte. In order to make this reaction most efficient and lasting, an appre-

ciable amount of dichromate has to be present in the bath, and as the potassium salt is not very soluble, sodium dichromate is more suitable. The basic electrolyte "A" was then saturated with sodium dichromate, with a marked improvement in results. Unfortunately it also had the effect of making the electrolyte too viscous, thus impeding good current distribution.

After several trials it was decided to keep the sodium dichromate content slightly below the saturation level, and further improvement was brought about by reducing the chromic acid content by almost half. These results suggested that a preferential reducing action was exerted on the dichromate rather than on the chromic acid, as it was found that the working life of the bath was not significantly altered by this decrease in chromic acid. Additional advantages were that the conductivity of the bath was greatly increased, and a lower current density could be used. The eventual decrease in the conductivity persisted, however, though to a slightly lesser degree.

The new basic electrolyte, which will be called "Basic Electrolyte B," had now the following composition:—

Water, 65 to 92.5 per cent by weight; orthophosphoric acid, S.G. 1.75, 35 to 7.5 per cent by weight; chromic acid, 110 to 250 gms. per litre of the mixture. Sodium dichromate was added to within 5 to 15 per cent (by weight) of saturation level.

At a temperature of 75° F. the current density range was now from 120 to 1,000 amps. per sq. ft., and when freshly prepared a current density of 150 to 200 amps. per sq. ft. was achieved at as low a pressure as 4 to 6 volts with an electrode distance of 7 in. After about 120 ampère-hours per gallon, a pressure of up to 14 to 16 volts was needed to overcome the increased resistance of the bath.

Improvement of Finish

The current distribution of the solution, however, was not yet satisfactory enough to allow the continuous processing of intricately shaped articles on the large scale. The finish seemed to be more "grainy" than was desirable, and means had to be found to overcome these defects. The primary problem was to find an addition agent which would increase the internal current distribution of the bath without exerting any appreciable attack on the anode material, or impeding the efficiency of the constituents already present. After some experiments an ideal substance was found for the purpose — sulphamic acid ($NH_2.HSO_3$) — a non-hygroscopic solid of good solubility, a very high degree of ionization and good conductivity. Unfortunately its use could not be considered on a very large scale, as at this time it was only obtainable in small quantities in this country. The price, also, was rather high. Small-scale experiments employing between 50 to 120 gms. of ($NH_2.HSO_3$) per litre of basic electrolyte "B" gave the required result, but as it was intended to use upwards of 1,000 litres of solution, the quantities involved made the use of sulphamic acid prohibitive at the time. Further experiments suggested that the following radicals were likely to prove of use: nitrate, sulphate, borate, fluoborate, fluoride, fluosilicate.

Nitric acid was ruled out because of its highly critical concentration—the slightest excess marring the surface finish. Boric acid was only partially effective unless used in excessive quantities, which defeated the object of good conductivity. Similarly, fluoboric acid was not entirely satisfactory. Fair results, however, were obtained by the use of hydro-fluoric and hydrofluosilicic acids, especially in conjunction with sulphuric acid. Prolonged trials resulted in the adoption of a mixture of sulphuric and hydrofluoric acids, in quantities of 80 to 150 gm. of H_2SO_4 and 6 to 40 gm. of HF per litre of basic electrolyte "B." An excess of sulphuric acid was found to cause a chocolate brown stain on those portions of the anode surface which received the least current, and it was found that this stain was caused by an excessive rate of polarization where the formation of viscous anolyte film was least. The sulphuric acid thus showed a distinct tendency to reduce the electrical insulation afforded by the anodic film, and this had to be counteracted.

The problem was to find a substance which would bring a sufficient amount of anode material into solution as a compound with a very high electrical resistance, thus restoring the insulating properties of the anodic film, now impaired by the presence of sulphates. Experiment failed to reveal any inorganic substance which would serve the purpose. A reduction in the sulphuric

TABLE I

Defect	Cause	Remedy
Sludge settling on anode surface	Excess CrO_3 or $Na_2Cr_2O_7$	Dilute to 36° Bé and make up solution to balance
Brown staining	Excess H_2SO_4 or lack of CrO_3	Add 10 lb. CrO_3 per 100 galls. of solution
Yellow staining	Lack of organic acid	Add 1 to 2 oz. per gall. of acetic or propionic acid
Roughness of anode surface	Lack of H_2SO_4	Add ½ fl. oz. per gall. H_2SO_4 (1.84) and 1 oz. per gall. HF (40 per cent)
Excessive anode corrosion	Lack of H_3PO_4	Add 1 oz. per gall. H_3PO_4 or more as necessary
CrO_3 crystallizing on anode surface	Electrolyte is cold	Heat electrolyte to 80° F. and add 1/5 oz. per gall. of sodium benzene sulphonate
Anode matt on points	Excess current	Reduce current density
Anode matt except on points	Insufficient current	Increase current density
Lack of polish	Electrolyte too hot	Cool electrolyte
Anode crystalline and unpolished	Anode material contains lead or tin	Use high phosphoric acid electrolyte
Nickel plate strips and adhesion is poor	Neutralizer exhausted	Make up fresh neutralizer

acid content was only partially effective, the sole change observed being that the stains on the anode surface were yellow instead of brown. Experiments were now made with organic substances, of which there is a wide range of compounds which would be suitable as addition agents. The range was narrowed down because many organic substances would rapidly decompose through the oxidizing action of the electrolyte. Compounds containing a carboxyl group seemed to be the most suitable, as many of them have a high electrical resistance. In theory, therefore, the use of such compounds would be satisfactory, provided that they were stable within the bath and sufficiently reactive to convert some of the more conductive anode-corrosion products, or the anode material itself, into electrically resistant organic compounds.

This theory was proved in practice, and most of the saturated fatty acids, *e.g.*, propionic acid, acetic acid, formic acid, were found quite satisfactory in concentrations of between 50 and 200 gm. per litre of basic electrolyte "B." It was also found that certain aliphatic hydroxy acids could be employed with equal success, in view of the fact that the oxidizing action of the bath tends to convert them into lower derivatives (*e.g.*, lactic acid is oxidized to acetaldehyde and actic acid). Further experiments led to the adoption of either propionic or acetic acid, in a concentration of between 90 and 160 gm. per litre of basic electrolyte "B," which effectively prevented discoloration of the anode surface provided that sufficient chromic acid was present in the electrolyte to prevent any polarization staining caused by the sulphuric acid. With these additions a much smoother finish was obtained, which in many cases could well compare with hand-polished work, while its reflectivity was exceptionally high.

An electrolyte finally typifying the form now adopted had the following composition:—

Water, 70 to 90 per cent; phosphoric acid, 10 to 30 per cent; chromic acid, 180 gm. per litre; sodium dichromate, 420 gm. per litre; sulphuric acid, 80 to 95 gm. per litre; hydrofluoric acid, 3 to 6 gm. per litre; propionic acid, 80 to 150 gm. per litre.

Operating Conditions

Temperature: The temperature range was wide, lying between 60 and 120° F. At higher temperatures the insulating properties of the film are broken down, resulting in a patchy, pitted surface. The optimum was found to be at about 75° F.

Current Density: The general range has already been mentioned, but the optimum was found to be between 140 and 350 amps. per sq. ft. at the temperature stated.

Electrode Area: Experiment showed that maximum "throwing power" was obtained when the interelectrode distance was between 12 and 30 in., 20 in. being the optimum distance. A small cathode area was preferable when polishing large numbers of articles simultaneously, as this resulted in a more even finish owing to better current distribution. Cathodes of small area trained from all angles at the anode surface, at the distance stated, gave best results; this was in accordance with expectations, as the current distribution over an electrode of large area (*e.g.*, a flat sheet) varies considerably; the relative variation could be reduced by employing small cathodes at large distances, thus making most use of spacial compensation for lack in current distribution. It was thence adopted that the ratio of cathode area: anode area should not exceed 1 : 1.

Voltage: Under the conditions stated an average of 14 volts was found necessary.

Time of Treatment: This varies for each type of article. Normally about 4 min. are required under the above conditions, but it depends upon the initial state of surface of the anode. The general limit is between 2 and 7 min. under the stated optimum conditions. The amount of metal removed varies, depending upon the composition of the brass. Yellow brass is dissolved at the rate of about 0.0003 in. per min., and it may in some cases be necessary to remove up to 0.003 in. to 0.005 in. for the best possible finish, comparable with hand-polished work. The rate of attack is greater at higher temperatures, and also depends upon voltage and current density.

Further Applications

The process was put into production in 1945, and was applied to a very large run of cruet-tops, which were subsequently bright-nickel and chromium-plated. A special neutralizing dip had to be applied prior to plating in order to dissolve the anodic film, some of which was absorbed by the surface of the article after treatment in the polishing bath.

For other purposes it was found, however, that by introducing certain compounds into the solution an anodic film could be produced which, when absorbed by the anode surface after treatment, formed a transparent corrosion resistant layer upon the surface, thus protecting it like a coating of lacquer. This film not only afforded considerable protection to the brass against tarnish and atmospheric corrosion, but it was also virtually impossible to remove it without attacking the brass itself. It is not possible to electrodeposit other metals upon brass which has been treated under such conditions, adhesion is practically nil, and the deposit is stained and patchy, and care must therefore be taken to prevent certain compounds which cause that effect from entering the solution.

The electrolytic polishing process is theoretically applicable to all articles made out of copper or yellow brass, especially 70 : 30 (or cartridge) brass. In fact, however, it is not as yet possible to polish articles possessing large, uninterrupted flat areas, as the finish obtained in such areas is not sufficiently smooth. Provided, however, that there are sufficient interruptions on the surface, such as rims or engine turning, articles of considerable area can be polished with great success. The maximum flat area which will normally lend itself to polishing on a production run was found to be about 3 in. by 3 in. but articles whose surfaces are interrupted by patterns, holes, etc., have been successfully treated up to a total area of more than 100 sq. in., the only limit being such factors as power supply and economy in jigging. Specially constructed steel jigs were used throughout, though connecting clips were usually made of copper. It was not found necessary to apply any stopping-off material to the jigs, and although this caused slightly increased power consumption, this increase was very small. Undue build-up in the plating process following electrolytic polishing was prevented because the anodic dissolution of the electrodeposit upon the exposed portions of the jigs was practically equivalent to the amount of build-up caused during the plating operation. Although the process could be run slightly more economically with suitably protected jigs, no easily applicable insulating ma-

terial was found which would withstand all the solutions and conditions to which it would be subjected, while any slight flaw in the coating of such jigs would cause considerable damage through drag-over of solution absorbed in the crevices. Also, the cost of keeping numerous jigs properly insulated would have been greater than the slight additional expense caused by the waste of current and nickel when using unprotected jigs.

Generally speaking, the process is most practicable when large quantities of small articles are to be processed, when it gives consistent and quite presentable results. The process has been in continuous use for over a year, and with six operators more than 100 gross of cruet tops have been processed daily, in bright-nickel and chromium finish (including jigging and unjigging, inspection, counting and drying out). In its early stages the percentage of rejects was rather high, being almost 4 per cent, but after some experience this has now been reduced to an average of about 0.8 to 1.25 per cent.

Certain small eyelets are being processed for a large firm of motor-car accessory manufacturers; these eyelets are very small, and it is very difficult to hand-polish them in large quantities. By means of this electrolytic process it is possible to process and bright-nickel and chromium-plate 5,000 eyelets per day, in addition to the 100 gross of cruet tops, without additional labor.

Brasses Containing Lead

The process is not applicable to articles made out of brasses containing more than 0.3 per cent lead or tin. For such articles a different electrolyte has been developed, with a high phosphoric acid content and with little chromic acid present. By employing this type of solution it is possible to polish brasses containing up to 1 per cent of lead, which is seldom exceeded in sheet brass. The process gives a finish quote equal to the one previously described, but requires much longer treatment time. The reason for this is that this electrolyte, while containing the same constituents as the other solution in different proportions, contains a larger quantity of phosphoric acid, the weight to weight ratio between H_3PO_4/CrO_3 being above 10/1, and thus gives rise to a predominantly gaseous anodic film. By using both processes consecutively, the time of

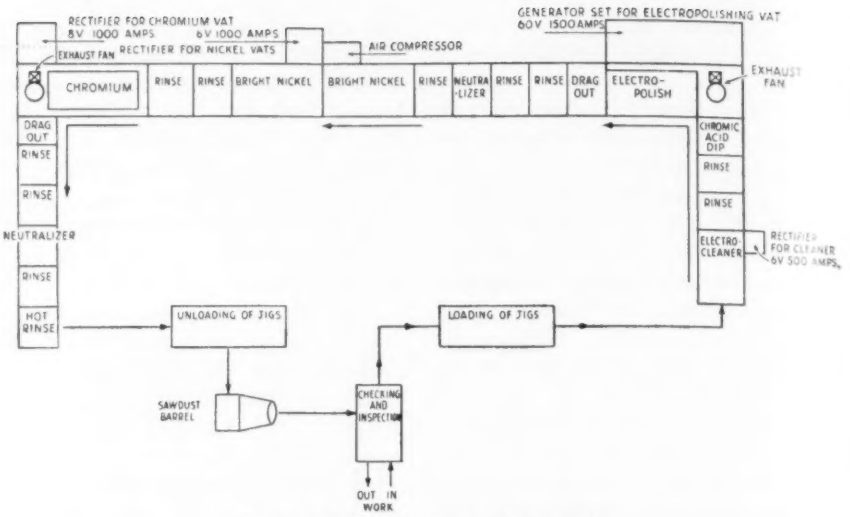

Fig. 1—A schematic layout of the plant.

treatment may be cut down to about 5 min., only 0.001 to 0.002 in. of metal being removed. In this case, however, a special neutralizing treatment has to be used prior to electrodeposition of other metals on to the brass, as a more obstinate anodic film is absorbed by the surface which cannot entirely be removed by a simple dip. This process is applicable to a wider variety of articles, including castings, although the limitation on the size of uninterrupted, flat surfaces still holds.

Considerable attention must be paid to the original condition of the anode surface. Articles showing surface cracks, "orange peel effect" and similar roughnesses can only rarely be treated satisfactorily on a production basis, and discretion must be used in the choice of articles which are to be processed. Any such surface irregularities in the original anode material tend to be emphasized during treatment, and it is necessary to remove a prohibitively large quantity of metal in order to make the surface sufficiently smooth. A slight "orange peel effect" is not objectionable in the case of the high-chromic-low-phosphoric acid type of electrolyte, while the high-phosphoric-low-chromic acid type of solution permits a still wider margin of surface irregularities.

The process is to some extent applicable to electro-deposited copper and brass, provided that the surface of the underlying base metal is reasonably smooth, and that not less than 0.002 in. of deposit have been applied. The high-phosphoric-low-chromic acid type of electrolyte is much more adaptable for the electrolytic polishing of electrodeposits, as it does not remove more than 0.00005 in. per min.

Practical Points and Equipment

When jigging small articles there must be absolutely positive contact, and excessive proximity between articles must be avoided. Hollow articles should be suspended so as to allow liquid to drain freely from them. On the other hand, the gas evolution from concave surfaces should not be impeded. This consideration does not apply to hollows which do not require polishing, *e.g.*, the insides of pepper-pot tops, as, in this case, the free drainage of liquid is more important in order to prevent carry-over of polishing electrolyte. Sharp points and protrusions should not face downwards, in order to avoid excessive attack on them. In order to prevent the formation of "gas streaks," *i.e.*, deep furrows cut into the anode surfaces along the path of the evolved streams of gas bubbles, vigorous air agitation of the electrolyte must be employed. This will also ensure proper circulation of the electrolyte, and result in a superior finish. Heating arrangements are unnecessary except on very cold mornings when starting-up the plant, when an open-end steam pipe may be inserted into the solution until a temperature of 70° F. is reached. The heating effect of the current is considerable—one gross of cruet tops are being processed at a time, consuming 1,200 amps., and the process is continuous, being chain-worked, and so some cooling arrangement is desirable, preferably a cold-water coil of large exposed area immersed in the solution through which cold tap water may be circulated at intervals. The outlet of the coil may conveniently end in the first rinsing tank, providing an

ample supply of rinsing water. It is also desirable to employ air agitation of all water swills to ensure complete removal of all traces of polishing electrolyte prior to plating.

The Complete Cycle

A schematic lay-out of the plant, which is of the "straight-through" type, is shown in Fig. 1. The plant is being chain-worked, but not automatically.

The following cycle was adopted for cruet-tops: (1) unwrap as received from the press and load on special jigs; (2) clean electrolytically in standard hot alkali cleaner at 6 volts for 1 min. or more; (3) cold rinse; (4) acid dip in chromic acid; (5) electropolish for 3 min. in low phosphoric acid type bath; (6) drag-out rinse; (7) cold rinse; (8) cold rinse again; (9) special neutralizing dip for 1 to 5 sec.; (10) cold rinse; (11) bright nickel plate in modified Weisberg type bright nickel bath to thickness of 0.0003 to 0.0005 in.; (12) cold rinse; (13) cold rinse again; (14) chrome plate under normal conditions; (15) rinse, neutralize, hot rinse; (16) unload jigs; (17) barrel in hot sawdust for 1 min. until dry; (18) inspect, count and wrap up, ready for despatch.

All rinses were air-agitated, and had a liberal supply of running water. Electric power was supplied from a standard anodizing generator, giving 1,500 amps. at a maximum of 60 volts. The full voltage was never used, and the usual loading was 16 volts at 1,200 amps. The steel jigs were specially designed, and were used right through the complete cycle. No stopping off was found necessary, as already mentioned, and the maintenance required was slight, being only the occasional replacement of one or two spring clips.

Control and Maintenance of the Polishing Electrolyte (Low-Phosphoric-Acid-Type)

For normal maintenance, an addition of 15 lbs. of chromic acid per 100 gal. is required every 30,000 ampère hr., with a daily addition of about 10 lb. per 100 gal. of sodium dichromate. 1 fl. oz. per gal. of sulphuric acid is added every 40,000 ampère hr. The defects most commonly encountered and their remedies are shown in Table 1.

Generally the working life of 200 gal. of polishing electrolyte was found to be four weeks, or 300,000 ampère hr., after which it was more economical to make up a new solution. An electrolyte costs roughly £18 per 100 gal. to prepare, and 200 gal. will process over 2,200 gross of such articles as cruet-tops.

Conclusions

Generally the process has been found most successful within its limitations. After the preliminary experience had been gained regarding materials, defects and their remedies, overheads were not excessive, labor costs were low and the output excellent. A variety of articles leads itself to the process, but it is most attractive for the continuous processing of large quantities in high production runs. Generally it may be said to have a bright future, and further researches are in progress.

It must be pointed out that patents have been taken out in this country and abroad for electrolytes and procedures, and in fairness to the interest of the assignees of these patents the author has been obliged to use discretion in his disclosures. It is therefore regretted that certain details have been omitted or described with intended vagueness, but it is nevertheless hoped that this paper will form some contribution to the subject of electrolytic polishing and be of some use to the metal finishing industry.

Acknowledgment

The author's gratitude is due to the directors of Messrs. W. Bate, Ltd., Hospital Street, Walsall, Staffs., for granting permission to disclose this process. Especial thanks are due to Mr. Geoffrey Bate, Managing Director of the company, whose consistent encouragement and criticism at all times formed a most refreshing incentive during the researches.

ELECTROPLATING IN A RAILWAY SHOP

(*Continued from page* 62)

When chrome plating for decorative purposes, the articles are given successive coats of copper and nickel before the chromium is applied. There are many items so treated. On passenger equipment cars some of the items are: door locks, baggage racks, grills in tavern cars, curtain fixtures, picture frames, light fixtures, water cooler parts, hopper fixtures, and strips of moulding used for decoration. On locomotives, some of the items are: hand rails, brackets, brake valves and handles, gauges, headlight rims, marker lights, and number plate rims.

When chrome plating for wear resistance, the hard chrome is deposited directly on the metal. Passenger car truck pins are ground undersized and restored to original size in this manner, the plate being .016" thick. Locomotive main and parallel rods, eccentric cranks and pins are plated for protection against lateral wear. Bell cranks, reverse yokes, lubricating stems, feedwater heater stems, piston heads and axles are plated in this manner. Many worn parts on machine tools in the shops are restored with the use of hard chrome plating, enabling the salvage of valuable parts. It has been found that the life of wearing parts can be lengthened in some cases more than 100 per cent by plating with hard chrome. When this chrome plate wears, it can be stripped and built up again. Hard chrome wear resistant plating takes from two to 60 hours, as compared with from two to five minutes of chrome over nickel for decorative purposes.

In the silver tank, in addition to the headlight reflectors, all dining and business car silver is refinished. Building hardware and desk trimmings used in the office buildings of the Railway are refinished by brass plating. Brackets used in tunnels are plated with copper for corrosion resistance. Contact parts for switch boxes, and all steel parts used for decorative purposes, are copper plated before being chrome plated. Various locomotive fittings and parts are cadmium plated to prevent corrosion.

Electro-plating is rightfully an integral part of a modern and progressive railroad.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating Nickel on Tungsten Carbide

Question: We are plating bright nickel on tungsten carbide parts that are soldered after plating. At present our rejections due to the nickel peeling off during the soldering operation are too high. Our cycle is reverse current clean (5 mins), rinse, muriatic acid dip (5 mins), rinse, nickel plate, dry in sawdust. Can you tell us how this problem may be overcome?

H. G. S.

Answer: I believe that the adhesion of the nickel to the carbide would be improved by an underplating of copper. The nickel deposits from a bright solution have a tendency to be hard and brittle, and the copper plating will help to anchor it more firmly to the carbide material. In soldering the heat should be kept away from the plated part as much as possible to eliminate the expansion of the metals as a factor in the problem.

Stripping Silver from Copper-Base Alloys

Question: Can you give us a formula for stripping silver plated deposits from copper and copper-base alloys, such as nickel silver?

T. R. B.

Answer: The following bath may be used for stripping silver:

Sulfuric Acid	19 parts by volume
Nitric Acid	1 part " "

The bath is used at a temperature of 180°F. The parts should preferably be dry when placed in this solution, as water in the bath may cause pitting.

Removing Carbonized Deposits

Question: We have the problem of cleaning off the carbonized deposits from the outside of large copper kettles formerly used for cooking apple butter over an open fire. We have tried several types of engine carbon removers to soften the carbon deposit, but none of them seem to work properly. Can you suggest a better method for cleaning these pots?

M. E. K.

Answer: The heavy deposits formed are a mixture of carbon and tarry compounds. The best way to remove such deposits would be to sand blast them off, but if this equipment is not available, you can use a paint stripper or remover to soften the deposits, then scrape off the loosened deposit with a knife, following this with a brushing operation using a wire wheel on a portable electric hand tool.

Plating Metals on Leather

Question: We are interested in producing a metallic effect on leather, and would like complete details of how to go about plating on such a material.

A. S.

Answer: Plating or metallizing leather is possible, but the flexibility which is inherent in the leather would be destroyed by surfacing it with a metallic deposit. A better method for producing a metallic effect and still retain the flexibility would be to use a flexible type of lacquer coating containing a metallic pigment. The names of firms who can supply such materials are being sent to you. For details on metallizing various non-metallic materials, the booklet "Metallizing Non-Conductors" by Samuel Wein would be helpful. Copies of this booklet are available from METAL FINISHING.

Heavy Nickel Plating

Question: Do you think that a heavy nickel plating could be used successfully to build up worn connecting rod journals for automotive and truck crankshafts? Will it be able to stand up under the sharp blows that it would receive in normal service and after the bearings get worn a little?

W. R. G.

Answer: Heavy nickel plating has been used very successfully in a number of applications similar to yours. As each application has certain conditions that require separate consideration, it is not possible to give exact details. If the application is one in which impact forces must be withstood, it would be best to deposit a nickel coating that would be fairly soft and adherent, rather than the hardest type of nickel deposit which might have a tendency to flake or chip under impact. The final surface could then be plated with chromium for extra surface hardness and wear resistance. A nickel thickness of .025" or better is recommended for an adequate base for the chrome.

Pitting in Nickel Plating

Question: Can you advise us as to whether peroxide or prepared anti-pitting agents are best for use in Watts type nickel baths?

W. E. P.

Answer: Both materials have their use in preventing pitting in nickel baths. However, the concentration of peroxide must be controlled very carefully, as an excess will produce very brittle deposits and poor throwing power. Not over a few c.c. per gallon are permissible. The same is also true of prepared anti-pit agents, but a wider range is usually permissible. Other helpful measures in overcoming pitting are the use of higher plating temperatures and agitating the cathodes.

Refinishing Old Silverware and Pewter

Question: We would appreciate your telling us the best method for refinishing old silverware which is made from pewter or Britannia metal. We have had difficulty in getting parts that were previously silver plated clean enough for a resilver job to adhere.

D. R. B.

Answer: In re-processing old pewterware or Britannia metal, the remnants of the original silver plating should be first removed by stripping the parts anodically in a 4 oz./gal. solution of Sodium Cyanide. The parts are then polished, buffed, degreased, cleaned cathodically in a mild solution of Trisodium Phosphate, rinsed, dipped in a 10% Muriatic acid dip, rinsed, then given a strike in a bath containing ½-1 oz./gal. of Silver Cyanide and 8-10 oz./gal. of Sodium Cyanide. This is then followed by the regular silver plating operation. Some operators prefer to use a 10% Fluoboric acid dip in place of the Muriatic acid dip, while others use a mercury dip instead of the acid dips. The mercury dip is made up by dissolving 1/3 of an ounce of Mercuric Nitrate in water, then adding Hydrochloric Acid to make the Baume reading about 7. If brass parts are liable to be processed through the same tanks, the use of the mercury dip should be avoided, as it may lead to season cracking of brass parts containing residual stresses from cold forming operations.

Cleaning Enamelled Copper

Question: Can you tell us how to clean enamelled copper coils so that they can be re-soldered again?

R. D. J.

Answer: The enamel should first be removed in a commercial enamel stripping solution or lacquer solvent. After this the parts should be degreased and bright dipped in a strong Nitric Acid solution, followed by thorough rinsing. This will give you a surface condition that will be excellent for soldering.

Acid Copper Plating

Question: We are plating copper on stainless steel using the conventional acid copper bath, rotating cathodes, in a lead lined tank using part lead and part copper anodes. The bath operates quite satisfactorily for about a month after making up, but then gives unsatisfactory results. The color of the bath then becomes a pronounced green instead of the usual blue. Our acid concentration runs as high as 15 oz./gal. in order to utilize highest current densities. Can you give us some explanation for our difficulties?

B. K.

Answer: Your trouble probably lies in the use of the lead anodes, which become coated with a film of lead oxides during use. As these loosely adherent lead oxides are light colored, they become dispersed throughout the bath and cause the change from blue to greenish blue. Filtering the bath often might help, but a better solution would be to use only copper anodes. This will cause a build-up in copper concentration of the bath, but portions of the bath can be discarded at intervals to maintain the correct composition. If possible, the copper anodes should be removed from the solution when it is not in operation, to eliminate chemical solution of the anodes.

Ventilation of Plating Tanks

Question: Can you tell us whether or not it is necessary to have ventilation on our cold Cadmium, Nickel, acid Zinc, or Cyanide Zinc plating solutions. We are under the impression that it is not necessary, and that our overhead room fans would be sufficient.

C. E. W.

Answer: Most installations of the above plating baths are operated without special ventilating measures being necessary, but of course adequate ventilation is always desirable even for these solutions. The use of an overhead fan for ventilation is not advised, as the fan may draw any fumes from the baths up into the face of the operators. Any auxiliary fans used for general air movement should be placed so that the fumes from any tanks are directed away from the operators working area.

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Patents

Electroplating Method Employing Pulsating Current of Adjustable Wave Form

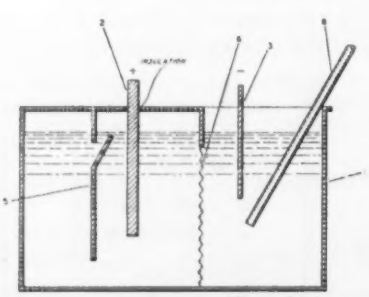
U. S. Patent 2,443,599. *Allan E. Chester, assignor to Poor & Co.*

In electro-plating of work employing an aqueous bath containing dissolved salts of the plating metal and an anode and wherein the work is the cathode, the method of obtaining rapid clean deposition which consists in applying to the cathode with respect to the anode a pulsating direct current voltage whose instantaneous value is always positive, said pulsating voltage having an unvarying direct current component and further having a sinusoidal alternating current component, the lowest instantaneous value of the said pulsating voltage at the negative alternating peak being between 0.5 volts and 1.5 volts, said direct current component having a voltage not substantially higher than 24 volts and said alternating current component having a frequency within the range of from about 25 to 60 cycles, inclusive.

Hydride Metal Cleaning

U. S. Patent 2,448,262. *Harvey N. Gilbert, assignor to E. I. duPont de Nemours & Co.*

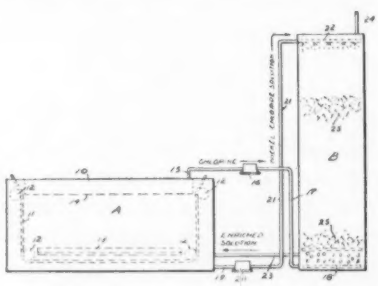
The process for removing oxide from the surface of a metal article compatible with fused alkali metal hydroxide which comprises electrolyzing a bath of fused alkali metal hydroxide with said article as cathode, separating the anode and cathode with a diaphragm, dissolving and maintaining 0.5 per cent to 10 per cent by weight of alkali metal hydride in said bath in the vicinity of the cathode, and dissolving alkali metal monoxide in said bath in the vicinity of the anode and maintaining said monoxide in an amount at least sufficient to react with all of the water formed at the anode.



Electrodeposition of Nickel

U. S. Patent 2,449,422. *Leslie N. Smith, assignor to The Harshaw Chemical Co.*

A plating process adapted for utilization of difficultly soluble masses of electrolytic nickel metal in electrodeposition of nickel comprising the steps of electrodepositing nickel from a body of acid nickel electrolyte containing nickel chloride whereby chlorine is evolved and the nickel chloride concentration of said electrolyte tends to be reduced and adding nickel chloride to said electrolyte to counteract the tendency to reduced concentration thereof by passing chlorine so evolved and electrolyte from said body of elec-

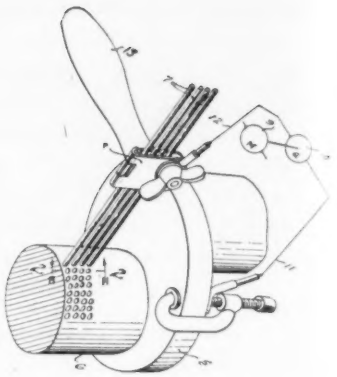


trolyte containing nickel chloride equivalent to from 75 to 350 grams per liter of $NiCl_2 \cdot 6H_2O$ into simultaneous contact with masses of difficultly soluble electrolytic nickel whereby to dissolve nickel for such masses as nickel chloride and returning such electrolyte with its resulting increased nickel chloride content to said body of electrolyte.

Surface Treatment of Metal

U.S. Patent 2,449,917. *John A. Tansley, assignor to Chrysler Corp.*

The method of preparing a surface of a metallic article for receiving a layer of metal to be fixed thereto which comprises positioning said article and a carbon electrode in electric circuit with a source of electric energy, relatively moving said article and electrode alternately from one spaced relationship to another spaced relationship to respectively create and break an electrical arc therebetween, and subjecting successive selected areas of said surface to the arc so created under conditions of current flow sufficient to fuse



the metal at said selected areas and to displace at least a portion of such fused metal into projecting relationship from other areas of said surface adjacent said selected areas.

Electroplating Apparatus

U. S. Patent 2,447,270. *Rodney H. Olsen.*

In an electroplating apparatus, a tank open at its top, suspension bars of conductive material extending horizontally in said tank and insulated from each other, a base bar of insulating material extending across said tank and provided with longitudinally spaced sockets adapted to receive and removably support in upright position hollow articles to be plated constituting cathodes, uprights rising from the base bar adjacent opposite sides of the tank, a manifold pipe of conductive material extending horizontally over the base bar in upwardly spaced relation thereto and supported upon said uprights, perforated tubes removably carried by and extending downwardly from said manifold pipe and constituting anodes for extending into the articles to be plated and having their upper ends communicating with the manifold pipe, said tubes being of predetermined length for disposing their lower ends in predetermined spaced relation to lower ends of said articles, a horizontally extending bus bar of conductive material, means for releasably securing the bus bar across the said articles transversely thereof and in conductive engagement therewith, a vertically extending conductor strip connecting said bus bar with one of the bars in the tank, a vertically extending conductor strip connecting the other bar in the tank with the manifold pipe, and a pump having an inlet pipe extending into the tank and an outlet pipe connected with the manifold pipe.

A COMBINATION THAT IS HARD TO BEAT

Cowles

KW *and* SK

(Formerly SOAKLEEN)

All subsequent cleaning operations are reduced to a minimum by using K W alkaline cleaner and S K emulsion type cleaner together in the pre-soak operation. These two fast acting, efficient and economical cleaners do a real job of removing oils and stubborn soil when used in combination.

K W Cleaner alone will handle all cleaning operations after the soak cleaning. It can be used in still tanks—with or without electric current—and in all standard washing machines.

COWLES TECHNICAL SERVICE ON REQUEST

PROMPT SHIPMENTS FROM LOCAL STOCKS

Cowles Chemical Company

FORMERLY THE COWLES DETERGENT COMPANY

METAL CLEANER DEPARTMENT • CLEVELAND 3, OHIO

Terne Electroplating Bath

U. S. Patent 2,446,716. *John S. Nachtman.*

A terne electroplating bath formed from the following components substantially in the ratios set out: white lead—112.5 g./l., stannous oxide—11.35 g./l., boric acid—186.8 g./l., hydrofluoric acid (30%)—650 g./l., nicotine—10 g./l., and beta-naphthol —2 g./l.

Tin Plate Treatment

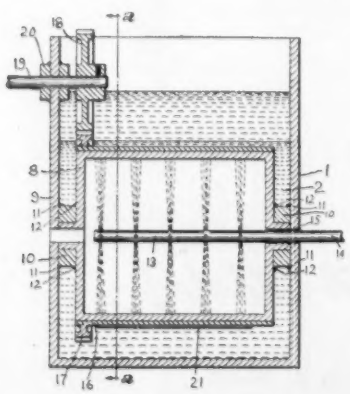
U. S. Patent 2,450,509. *Charles E. Glock, assignor to Crown Cork & Seal Co., Inc.*

In the method of treating a continuous strip of tin plate in a line wherein the tin coating is electrolytically deposited and then flow brightened, the steps of treating such bright finished tin plate to render the same resistant to the action of food acids and sulphur stains comprising subjecting the surface of the flow brightened tin plate to a light rubbing action which does not deteriorate the flow brightened finish, then subjecting the brightened tin plate to an aqueous alkaline electrolytic bath in which the tin plate is the cathode for from about three to about ten seconds, the bath being maintained at a temperature between about 170° F. and 200° F. and the current density at the cathode being about ten amperes per square foot to about 100 amperes per square foot, the bath consisting essentially of about .3% to 2.0% sodium dichromate and about 1.5% to 6% trisodium phosphate.

Plating Sheet Metal

U. S. Patent 2,449,329. *Harry Sebell, assignor to Bell Products Corp.*

A machine for coating metal comprising a pot for containing molten tin,



a stationary drum submerged in the mass of molten tin, means for heating said drum, a sleeve encircling the drum and with which the sheet metal to be plated has contact, and means to turn the sleeve on the drum, thereby to assist in feeding the sheet metal through said tin bath.

Sand Blast Nozzle Control

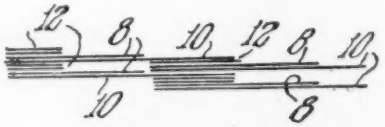
U. S. Patent 2,449,672. *William A. Rich.*

In combination with a hose and a nozzle, means for controlling the movement of the nozzle, comprising a swivel fixed to the hose adjacent the nozzle, a clamp fixed to the hose rearwardly of the swivel, and means for resiliently joining the swivel and the clamp, whereby the hose may be flexed between the swivel and the clamp.

Buffing Wheel

U. S. Patent 2,450,454. *Sheldon S. Smith.*

A buffing wheel comprising in combination, superposed and centrally se-

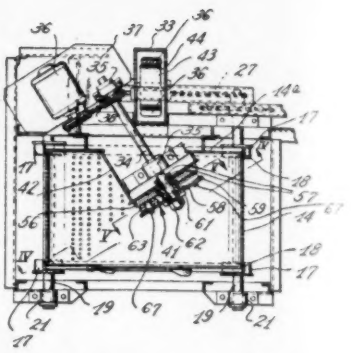


cured together layers of circumferentially arranged flexible sections, each of said sections including a folded disc having a forward two ply portion with a forward folded edge and an intermediate four ply section with a forward folded edge angularly and rearwardly disposed relative to the first edge and a rear eight ply portion with a forward folded edge angularly and rearwardly disposed relative to the second-named edge, the two ply portions of the sections of each layer superposed on the eight ply portions of adjacent sections and the eight ply portions of the sections of one layer superposed over the corresponding portions of the sections of the layer therebelow.

Shot Blasting Machine

U. S. Patent 2,449,745. *Walter E. Jewell.*

A shot blasting machine comprising a rotatable tumbling drum having a generally horizontal axis, a generally horizontal rotatable shaft projecting into the drum at one end thereof and at an acute angle to the drum axis, and



a narrow shot-throwng wheel disposed on the shaft inside of the drum so that a shot pattern may be thrown diagonally across the drum to cover the entire axial length of the drum.

Direct Coating of Silver on Iron or Steel

U. S. Patent 2,449,726. *Alfred Daniel Slatkin, assignor to Arthur F. Cutten.*

The process of applying directly to a ferrous metal cathode a coating of silver comprising; placing said ferrous metal cathode in an aqueous bath having sodium cyanide 8 to 15 ounces, silver cyande ¼ to 2 ounces, sodium chloride ¼ to 2 ounces, potassium carbonate ⅛ to 1 ounce, to a gallon of water; placing an iron anode in said bath and passing an electrical current of a value between 30 to 200 amperes per square foot of surface area of the cathode, between said anode and cathode.

Electrodeposition of Tin

U. S. Patent 2,450,794. *Elmer F. Harris, assignor to Carnegie-Illinois Steel Corp.*

The method of electrodepositing tin which comprises providing a tin anode in an electrolyte, making the article upon which the tin is to be deposited the cathode in such electrolyte, the electrolyte consisting of an aqueous solution of the followng ingredients:

Tin	10-60 g./l.
Phenol sulphonic acid	35-110 "
Dihydroxy diphenyl sulphone	1-9 "
Monobutyl phenylphenol sodium monosulphonate parts by million by weight	5-2000

and passing an electric current between the anode and cathode having a current density of at least 20 amperes per square foot of cathode surface in the electrolyte.

Engineering Information Useful In Designating Metallic Surface Treatments

Engineering Data Sheet

Anodizing of Aluminum Alloys

The formation of oxide coatings on aluminum alloys by electrochemical means is an important process for providing increased corrosion and abrasion resistance, and providing a base for colored dye treatments and painting. Many baths have been developed, the more important practical features being listed in the following tabulation:

PROCESS	OPERATION	ADVANTAGES	DISADVANTAGES	REMARKS
Sulfuric Acid	***Bath*** Sulfuric acid 10-30% aqueous solution. Temp. 75°F. Voltage 10-20 v. D.C. or A.C. C.D. 12-15 amps./ft.²	Hard films formed resist abrasion. Thick films .0001-.0004". Voltage adjustment not required during first few minutes. Transparent, colorless to pale grey films, ideal for dye coloring. Time 10-30 mins. gives adequate film.	Patented process, available under licensing arrangements from Aluminum Co. of America. Not recommended for parts where solution may be trapped in crevices, due to subsequent deterioration by acid attack. Metal loss by solution higher than in other processes.	Lead or rubber-lined tank required. Heating and cooling coils required for close temp. control. Alloys containing copper may require special treatment for uniform results. Sealing treatments recommended for best results following anodizing or dyeing. Bath becomes contaminated by Aluminum build-up, and must be discarded when alum. content reaches about 1-1½ oz./gal.
Chromic Acid	***Bath*** Chromic acid 10-15 oz./gal. Temp. 95-100°F. Voltage 0-50 v. D.C. C.D. 3-10 amps./ft.²	Throwing power of process very good. Very dense coating formed. Very little metal loss by solution.	Longer time cycle required, up to 1 hr. Films are much thinner, about .0001". Films vary from light yellow to dark brown, and are less suitable for dyeing. Definite voltage increase cycle required throughout treatment. High copper and silicon alloys produce inferior films.	Steel or lead-lined tank suitable. Bath must be agitated, and temperature controlled closely. A modified, shorter cycle is possible, producing much thinner films suitable as a paint base. Solution must be discarded when aluminum chromate build-up becomes excessive.
Oxalic Acid	***Bath*** Oxalic Acid 5-10% sol. Temp. 85°F. Voltage 50-65 v. D.C. C.D. 10-30 amps./ft.²	Moderately hard and abrasion resistant coatings. Color of films can be varied by operating conditions. Time required about 20 mins. for .0001" films. Bath is less corrosive than chromic or sulfuric types.	Current consumption is high. Films are yellowish to brown, and not as suitable for dye coloring as those produced in the sulfuric process. Voltage must be built up slowly during processing cycle.	Rubber-lined or lead-lined tanks suitable. A.C. may be superimposed on the D.C. to produce other colored films.
Phosphoric Acid	***Bath*** Phosphoric acid 55-60% aqueous sol. Temp. 85-90°F. Voltage 5-30 v. D.C. C.D. 10-20 amps./ft.²	Hard, durable films formed. May be used as a base for electroplated deposits. Shorter processing time (5-15 mins.), but films are thin, in the order of .0001".	Alloys containing copper and silicon require special treatment to produce uniform coatings. Lower acid concentrations and higher temperatures help. Voltage cycle must be followed throughout anodizing process. Films not as suitable for coloring as those from sulfuric bath.	Rubber-lined or stoneware tank required. Heating and cooling provisions necessary. Lead cathodes. Light etching in caustic recommended before anodizing.
Sulfamic Acid	***Bath*** Sulfamic Acid 6.5-13.4 oz./gal. Temp. 120°F. Voltage 15-25 v. D.C. C.D. 6-25 amps./ft.²	Short processing cycle—15 mins. Clear, absorptive films formed, suitable for dye coloring and sealing treatments. Suitable for continuous processing.	Patented process (Reynolds Metals Co.) Voltage build-up cycle required during processing. Slight unstability of the bath may require frequent changing.	Stainless steel or acid resistant lining required for tanks. No etching treatment required before anodizing. Usual sealing treatments as used for other processes are suitable.
Boric Acid	***Bath*** Boric Acid 12 oz./gal. Borax ¼ oz./gal. Temp. 200°F. Voltage 230-250 v. D.C. C.D. 10-40 amps./ft.²	Very hard, impervious films formed. Films have very good insulation properties. Sealing treatments after anodizing not usually required. Time of treatment short, about 15 mins.	Films formed are very thin, due to impermeable nature of the oxide formed in this bath. Films are too thin for suitable coloring, and too impervious to absorb sealants and dyes. High temperatures and high voltage equipment required.	Steel or Lead-lined tank suitable. Cooling coils usually not required, as bath operates close to boiling point.

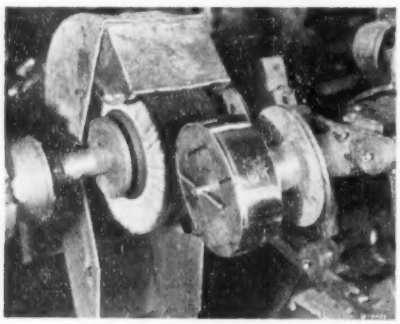
Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Tampico Brushes Cut Time for Toaster Shell Polishing

Osborn Mfg. Co., Dept. MF, 5401 *Hamilton Ave., Cleveland* 14, *O.*

Tampico power-driven brushing sections, used with automatic and semi-automatic holding fixtures and proper



polishing compounds, are speeding up numerous production line metal polishing operations.

One of the latest examples to come to Osborn's attention is the polishing of finished cold rolled steel toaster shells by the *Westinghouse Electric Corporation* at its Mansfield, Ohio, plant.

In this operation, a semi-automatic holding fixture is used in combination with Osborn Monarch untreated Tampico 14-inch sections and an abrasive compound. Polishing marks are smoothed out and the shells are ready for nickel-plating in approximately 45 seconds. The fixture and the eleven brushing sections which are assembled to make a wide face, are shown in the above illustration. Brushing speed is 1750 r.p.m.

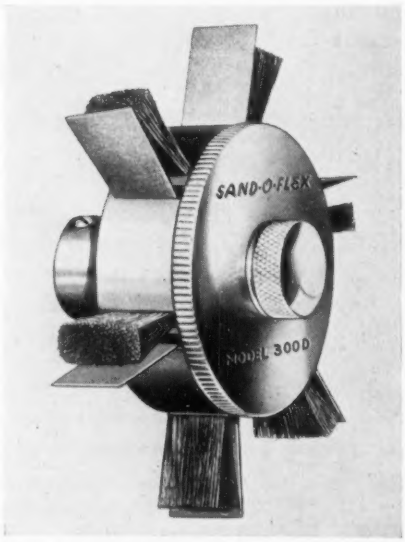
The Westinghouse method of processing its toaster shells has been found to be a highly efficient one. Following stamping and forming, the shells are first polished on a buff setup with a 180-grain emery wheel to take out die marks and cut down the metal. The Tampico brushing operation is next and is followed by the nickel plating.

The shells are then color buffed, chromium plated and given a final color buffing in that order. The polishing wheel is located on one end of the double end jack, enabling the same operator to transfer them to the brushing fixture.

New Smaller Sand-O-Flex Sander

Merit Products, Inc., Dept. MF, 4373 *Melrose Avenue, Los Angeles* 27, *Calif.*

This firm is now introducing a smaller model of their sanding wheels to be known as 300D. It was designed primarily for the home workshop but has proven an efficient production tool



for finishing small parts too large to be deburred by tumbling.

Model 300D consists of an aluminum body which houses a cartridge of abrasive cloth containing six strands fastened to a single core. As the abrasive wears, it unwinds out through the housing, in front of six replaceable brushes. When the wheel is rotated the brushes "cushion" the abrasive and mold it to the work shape. This feature makes the Sand-O-Flex a popular finishing tool for all types of round and irregular shapes.

Abrasive cartridges are available in fine, medium and coarse grits in garnet cloth for woodworking, and aluminum-oxide cloth for metalworking. The shank is bored to fit either a ½" or ⅝" shaft. Model 300D may be used on most home power tools, portable hand drills, flexible shafts and motor shafts. It is finished with a baked-on enamel finish, weighs approximately 8 oz. fully loaded.

Sulfide Test Papers

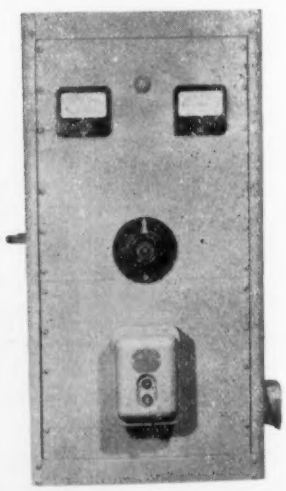
L. E. Lancy Laboratories, Dept. MF, 533 *Wampum Ave., Ellwood City, Pa.*

This firm announces a test paper for checking the sulfide additions to bright zinc plating baths. The papers are simple to use for accurate control, and eliminate waste and troubles due to excessive build-up of Sodium Sulfide, Sodium Calcium Polysulfide, etc. Instructions are included with each set of papers, and any tank operator can quickly make a test.

Plating Rectifiers

Cadillac Rectifier Co., Dept. MF, 3 *Howard St., New York* 13, *N. Y.*

This firm offers a complete line of



selenium rectifiers for the electro-plating industry in sizes from 10-5000

amperes. Features of these rectifiers include

1) Smooth variable voltage control, with no taps.
2) Oversized selenium stacks.
3) Overload protection.
4) Rugged design and pleasing appearance.

All Cadillac rectifiers are fully guaranteed. Complete details may be obtained by writing to the above address.

Bureau of Mines Approves New Sand Blast Helmet

E. D. Bullard Co., Dept. MF, 275 Eighth St., San Francisco, Calif.

Approval Number 1921 has been granted the new Bullard lightweight Sand Blast Helmet by the *U. S. Bureau of Mines.* New materials, plus new and improved design, contribute unusually long service life, sanitary features, and wearing comfort, it is claimed.

The outer hood is Neoprene rubber covered Fibreglas, offering high resistance to abrasive materials while retaining light weight and flexibility. Seams are vulcanized to further prolong the useful life of the helmet.

Adding to the wearer's comfort is a completely self-adjusting knitted elastic neckpiece attached to the inner cape. The cape is readily removed by means of a zipper, which permits cleaning with ordinary soap and water or any antiseptic. This material is also rubberized for long life and its easy cleaning qualities.

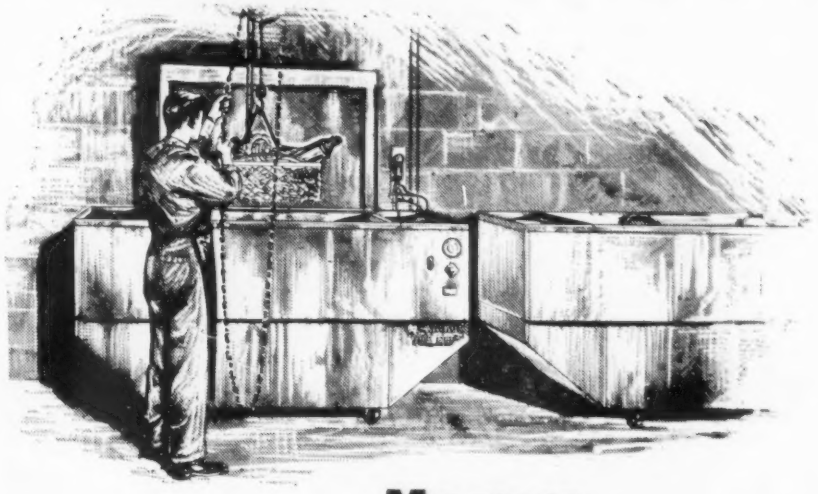
Built around the famous Hard Boiled Hat, this Sand Blast Helmet is readily sized to fit any head comfortably. The full-floating hammock and sweatband can be removed in a matter of seconds for either replacement or thorough cleaning, according to this firm.

Freedom of motion is afforded the wearer, as no part of the helmet rests on the shoulders or binds the arms. Wide web, six-point headpiece suspension distributes the weight comfortably to make this helmet easy to wear for long periods. Air is brought into the helmet across the facepiece to prevent lens fogging, and also to keep a direct airstream off the wearer's head.

Standard equipment includes a laminated lens and a clear cover glass, held in place with a retainer that needs no tools to remove or replace, and a screen facepiece cover for shot blasting. Com-

Put *Flexibility* into Your Metal Cleaning

Plus Better Work at Much Lower Costs!



Magnus
Aja-Dip Cleaning Machines

have shown that they clean faster, better and with less hand work in hundreds of metal cleaning installations. But you would be overlooking a tremendous additional advantage if you did not consider the greater *flexibility* of this type of *fast* batch cleaning and what it can mean to you in meeting changes in production schedules and unexpected cleaning jobs.

They clean fast, because the dynamic agitation of the up and down motion of the work IN the cleaning solution adds penetrating mechanical cleaning action to the chemical effects of the solution They clean thoroughly, usually eliminating hand work, because dirts are removed from *all* surfaces, even those normally considered inaccessible. And because a batch is so quickly finished, the machine is virtually always ready for a new lot of metal parts and for any change in cleaning solution that may be required.

A Type and Size to Meet Your Needs

These sturdy, powerful machines are made in a range of capacities to cover any schedule, handling from 75 to 2200 lbs. per load of basketed or racked parts.

Can we help you work out a more flexible, speedy cleaning schedule?

MAGNUS CHEMICAL COMPANY • 11 South Ave., Garwood, N. J.
IN CANADA—MAGNUS CHEMICALS, LTD., 4040 Rue Masson, Montreal 36, Que.
Service representatives in principal cities

Presto

BACK STAND IDLER

FEATURES LOW INITIAL COST

AVAILABLE NOW!

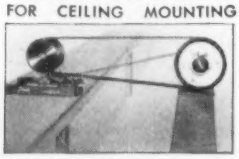
Easily and Quickly Adjusted for various length abrasive belts

Here's real convenience and economy . . . the Presto Back Stand Idler will fit most available space . . . and is adjustable to run close to equipment with a short abrasive belt or to extend to use a standard 168" abrasive belt . . . depending upon your requirements. This adjustment can be made quickly without moving the base.

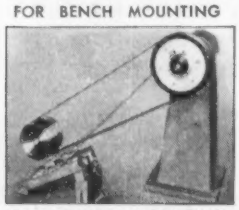
The Presto Back Stand Idler is of sturdy, all-steel, vibration-free construction . . . equipped with double-sealed precision ball bearings. It can be changed easily from right to left by loosening two set screws and reversing shaft. Adjustable belt tension is maintained by six leaf-type springs. You'll find its initial cost very economical and its performance is "tops". Send today for complete descriptive literature.

PRESTO UNIVERSAL BACK STAND IDLERS ALSO AVAILABLE

FOR CEILING MOUNTING



FOR BENCH MOUNTING



FOR FLOOR MOUNTING

Smooth, Cool-Running Presto Contact Wheels Will Not "Burn" Under Severest Conditions

The Presto Contact Wheel is of outstanding quality that gives fast, smooth, uniform cutting. Made of tough synthetic rubber, the even density of the face of the wheel is uniform throughout . . . for toughest snagging jobs or finest polishing. Available with *soft, medium, hard and extra hard* density.

The Manderscheid COMPANY

810 FULTON STREET
CHICAGO 7, ILLINOIS

BACKSTAND IDLERS · CONTACT WHEELS · TUBE POLISHING MACHINE · SPINNERS · BUFFING WHEEL RAKES · POLISHING WHEEL BUSHINGS · POLISHING LATHE WRENCHES, FLANGES, COLLARS & NUTS · SCREW POINTS · EMERY TROUGHS · BALANCE WEIGHTS & WAYS · TUBE SUPPORT STAND ·

• METAL FINISHING SUPPLIES AND EQUIPMENT •

plete approved helmet assembly includes belt, break-valve, and connecting hose. Approximate weight of the helmet is 5 pounds.

Abrasion-Wear Test Equipment

Taber Instrument Co., Dept. MEF, 111 Goundry St., No. Tonawanda, N. Y.

Model No. 100-109 is a new Abrasion Testing Set in the Taber line of standard rub-wear abrasion testers incorporating their unique rotary abrading action on a 4" specimen. The wear

results from alternately rubbing the flat faces of two resilient Calibrase wheels over the surface being tested. A range of standardized abrasive wheels are available for testing all types of surface finishes, including electroplate, porcelain enamel, organic coatings, leather, glass, plastics and woven textile fabrics.

New features include improved suction pump with vertical dust receiver with swinging nozzle fully adjustable for any thickness specimen. Different materials require a varying degree of suction cleaning while being tested, therefore, the control unit is equipped with a built-in variable transformer for adjusting the speed of the suction turbine motor. The control panel is also equipped with an adjustable timer to provide a test period of 1000 cycles, or less, and then automatically shutting off the power permitting the operating technician to be otherwise engaged in tabulating results or preparing new specimens without concern of overrunning the test being made.

Switches on the front of the control panel provide any combination of operating conditions, such as with or without vacuum pickup, continuous operation without timer or any timing up to 15 minutes.

An important feature of the new testing set is that the control unit is equipped for dual operation; that is, an additional Abraser unit can be located beside and connected with the

control unit thereby permitting two specimens to be tested simultaneously using the same controls and vacuum unit.

Three testing sets are offered by the manufacturer, each complete with parts and supplies for various types of testing.

An illustrated brochure containing important technical data and full description of Taber's unique rotary abrading action is available by sending your request to the manufacturer.

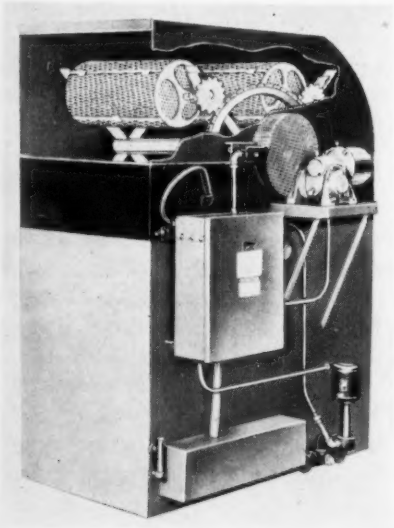
Barrel Degreasing of Small Parts

Phillips Manufacturing Co., Dept. MF, 3475 West Touhy Ave., Chicago 45, Ill.

Efficiency and economy in vapor degreasing is stressed in this firm's Tumbling Rotomatic, the newest innovation in conveyorized vapor degreasing equipment.

Ever since the introduction of vapor degreasing many years ago, there has been a need for a mechanism of this type. The necessary cleaning of innumerable small parts from an automatic screw machine, odd shaped bolts, couplings, small intricately shaped castings, hollow Dowell pins, and numerous other parts, is easily and economically accomplished with the Tumbling Rotomatic.

These parts when degreased in any type of standard vapor degreaser will



cup solvent in the crevices and hollows. When placed in a basket of a Phillips Tumbling Rotomatic for degreasing the basket is tumbled, which eliminates this cupping action and saves a great deal of solvent.

The tumbling basket is rotated by a

Where chrome contamination is a problem

USE WYANDOTTE NO. 90

Wyandotte No. 90 is a heavy-duty reverse current electrocleaner designed to remove fabricating compounds and smut from ferrous parts before plating.

Because of its extremely high chrome tolerance, it is especially valuable when used in automatic equipment where the work is not re-racked prior to chrome plating. With No. 90 in the cleaner tank, there's little danger of the chrome trapped in plating racks contaminating the solution.

No. 90 contains special ingredients which condition the solution water and improve rinsing. It does not foam excessively and has long life in solution. It is highly recommended for cleaning magnesium castings, copper, bronze, iron, beryllium copper and many alloys.

Why not get all the facts on this specialized Wyandotte Product? Remember, too, that Wyandotte makes the *complete* line of metal cleaners. For information, just call your nearest Wyandotte Representative.

Wyandotte
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WYANDOTTE CHEMICALS CORPORATION
WYANDOTTE, MICHIGAN • SERVICE REPRESENTATIVES IN 88 CITIES

THE Siefen System *

SPRAY EQUIPMENT
SPRAY COMPOUNDS
SPRAY SERVICE

* This is one of a series of messages describing the modern way of applying buffing and polishing compounds on revolving wheels. Rapidly becoming known as "The Siefen System" this system, based on Equipment, Compounds, Service, will step up your speed and efficiency while materially reducing your costs.

BUFFING AND POLISHING COMPOUNDS

SIEFEN compounds, such as Nuglu and Brushing Nuglu have been well-known and widely accepted for years. For the Siefen System new compounds have been developed.

Nu-Spra-Glu and Buffing Nu-Spra-Glu are familiar to many of you. These new and constantly improved compounds together with Siefen equipment and service will give you better work faster and at great savings.

REMEMBER—
The Siefen System

1. SIEFEN EQUIPMENT
2. SIEFEN COMPOUNDS
3. SIEFEN SERVICE

J. J. SIEFEN COMPANY
5627 LAUDERDALE • DETROIT 9, MICH.

small spur gear which in turn rotates on a large ring gear. As the reel rotates the tumbling baskets are in turn rotated around the ring gear as it goes down into the vapor, and still tumbling they come up on the other side. The tumbling basket makes approximately nine complete revolutions to each one revolution of the reel. Each tumbling basket is fitted with a tubular shaft with a spring stub-shaft carried on one end for loading and unloading, making these tumblers readily removable by merely compressing the spring and removing the tumbler.

Automatic Filter Cleaner Unit

Aget-Detroit Co., Dept. MF, 348 Main St., Ann Arbor, Mich.

An entirely self-contained automatic

filter cleaner unit for use in connection with its standard Model 1150 Dustkop Dust Collectors, which is designed to maintain initial suction, reduce filter replacement, and eliminate manual filter shakedown, is announced by this firm.

Principle on which the automatic self-cleaner operates is as follows: On certain buffing operations some of the finely divided lint fails to separate out in the cyclone. When it strikes the filter, however, the individual fibres tend to adhere to one another. Two or more of such fibres will always separate out in the cyclone. Thus, the automatic self-cleaner removes this lint, by suction, from the inner surface of the filter, and sends it through the cyclone again where, as described

above, the lint fibres are taken out of the air stream.

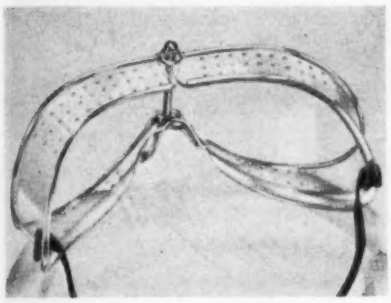
The automatic self-cleaning mechanism consists of a filter of spun glass and a motor driven nozzle which is enclosed within the assembly to reciprocate continuously over the inner surface of the filter. The nozzle is connected by a means of a flexible fabric hose, to the inlet of the cyclone. This provides the suction for the nozzle and at the same time establishes a re-entry to the cyclone for the lint. Peculiarly enough, the extra connection at the inlet for the nozzle does not cause any measurable decrease in the amount of suction available for the wheel hoods.

Installation of the automatic filter cleaner consists of removing the old filter assembly and placing the new automatic filter cleaner in position.

Plastic Safety Goggles

American Optical Co., Dept. MF, Southbridge, Mass.

A new development of this firm is



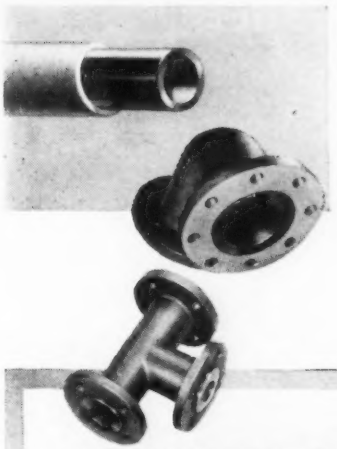
the Panoram plastic safety goggle, which is light in weight, shatterproof, and adjustable for every size face, it is claimed. A tight fit is assured by the swivel action of the eyecups and molded face-contacting cushions, and lenses are easily changed when they become scratched or clouded. Both clear and green lenses are available. Bulletin available on request.

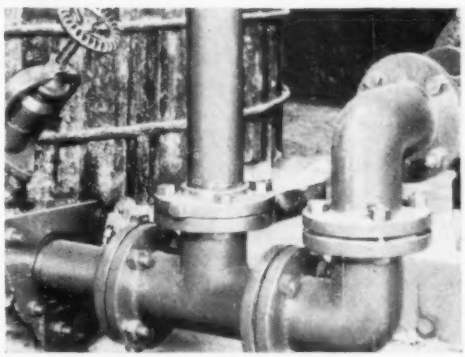
Automatic Process Washing and Pickling Machine

N. Ransohoff, Inc., Dept. MF, 1310 *Township Ave., Cincinnati* 16, *O.*

A release recently issued by this firm describes their new, completely automatic machine for washing, pickling and neutralizing parts on a batch basis. Parts are place in a rotating drum and the various processing solutions and rinses are pumped into the tank in which the drum revolves. After each solution has been allowed to do its job it is then pumped out of the tank

saran lined steel pipe





resists corrosion

- reduces shut-downs and lost production!
- saves time and labor!
- readily field-fabricated!

The conveyance of corrosive liquids can prove as hard on profits as it is on equipment. Saran Lined Steel Pipe is designed and constructed to protect YOUR profits. It combines the desirable features of steel pipe—rigidity and pressure strength—with Saran's unusual resistance to most corrosive chemicals, solvents, and erosion. Another advantage is ease of field fabrication. For general service, Saran Lined Steel Pipe can be used at temperatures between —40° and 190°F.

Saran Lined Steel Pipe comes in maximum lengths of 10 feet and in sizes from 1 to 4 inches. Plug valves and fittings, also Saran Lined, include elbows, tees, companion and reducing flanges, and gaskets. AVAILABLE IMMEDIATELY. Write us today for further information concerning Saran Lined Steel Pipe and how it can solve your problem. Manufactured by The Dow Chemical Company, distributed nationally by Saran Lined Pipe Company.

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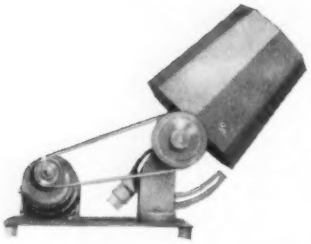
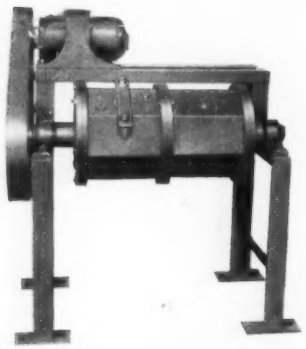
DOW
CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

ON SMALL JOB LOTS

FINISHING COSTS TUMBLE



TILT-TYPE BENCH MODEL — motor or belt driven. Adjustable elevation. Steel, wood, rubber lined or alloy metal barrels.



HORIZONTAL FLOOR MODEL — light duty for bulk tumbling and burnishing of small parts.

. . . . when you use a Henderson Oblique Tilt-type Bench Model Tumbling Barrel.

Ideal for SMALL-LOT FINISHING and SAMPLE LOT PRODUCTION of jewelry, clock parts and similar products requiring a *quality finish at minimum cost.* Widely used in laboratory experimental work.

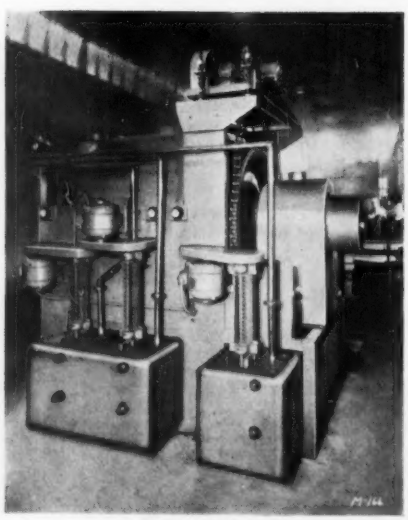
ALSO HORIZONTAL TUMBLING BARRELS — both light and heavy duty for small-lot and quantity production.

Tumbling barrels for every purpose or, made to order to meet your special requirements.

Write now for further information.

Since 1880 Designers and Builders of Tumbling Barrel Equipment.

THE HENDERSON BROS. COMPANY
135 SOUTH LEONARD ST. WATERBURY 85, CONN.



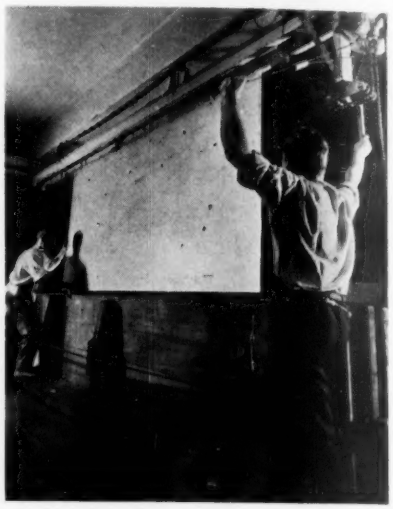
and into a storage tank. The length of each treatment is variable from 0-30 minutes as required for adequate processing. The machine utilizes very little floor space for its output, it is said, and once the parts have been placed into the machine they are not discharged until they are completely treated. All pumps and valves are fully automatic in action, and the cascading action of the parts during treatment is claimed to effect a more efficient and faster cycle. Any desired number of tanks and valves can be incorporated into this equipment, which has a built-in fume exhaust system and automatic timers for each cycle.

Further details may be obtained by writing to the firm at the above address.

Wood Tanks for Photo Developing

Wendnagel & Co., Inc., Dept. MF, 600 W. Cermak Road, Chicago 16, Ill.

A new and unique use for wood tanks in the metal working industries is for photo developing. The photograph shows one step in the development of photographs on metal plates.



This projection method puts engineering drawings, photographs, exact patterns of parts on metal templates.

Wood is highly resistant to decay, has high insulating properties, at low heat conductivity. Wood requires no painting or maintenance. The persistent use of wood tanks in the face of all other developments is an indication of their stable qualities.

Wood tanks and vats are made in all shapes and sizes. Round, rectangular, vertical, horizontal, with or without legs, to meet particular requirements. These tanks are designed by engineers, of tight and accurate construction, properly braced and made of Tank Grade Lumber.

Centrifugal Dryer

Nobles Engineering & Mfg. Co., Dept. MF, 745 E. 3rd St., St. Paul, Minn.

This firm has announced their new centrifugal dryer for small metal parts that can be handled in baskets. The unit is ruggedly constructed for long trouble-free operation, and has an internal suction fan that draws the air through the heating elements in the cover of the machine and then the

mass of spinning parts, drying them quickly. Steam or electric heaters may be used. A foot-operated brake is accessible from the entire working area, and the unit includes a heavy hinged cover and a totally enclosed ball-bearing motor. Baskets up to 12″ in diameter and 13″ high can be accommodated. Motor is a 1HP 220-440 volt 3 phase 60 cycle 1725 rpm, but other specifications can also be supplied. A V-Belt drive connects the motor to the spinner.

Non-Corrosive Pump

Vanton Pump Corp., Dept. MF, 7308 *Empire State Bldg., New York* 1, *N. Y.*

After two years of intensive research, development and practical application in the field, the above firm announces the availability for immediate delivery of its new "flex-i-liner" non-corrosive pump.

This unit is capable of handling successfully the many troublesome solutions involved in plating processes, as it solves the age old problem of contamination of the electrolyte by the elimination of packing. Since the pump avoids any entrapment of air in its lines, it is extremely desirable for agitation purposes. Vanton pumps are also suitable for use with filter units.

What makes the Vanton Pump different is its unique design and simple construction. The fluid is prevented from coming in contact with the metal parts by being confined between the outer surface of the Vanton "flex-i-liner" and the inner surface of the recessed hard rubber body. The Vanton "flex-i-liner" has been so adapted to the pump body that leakage to the metal parts is impossible.

Along with its non-corrosive features, the Vanton pump offers a number of other desirable characteristics, such as:

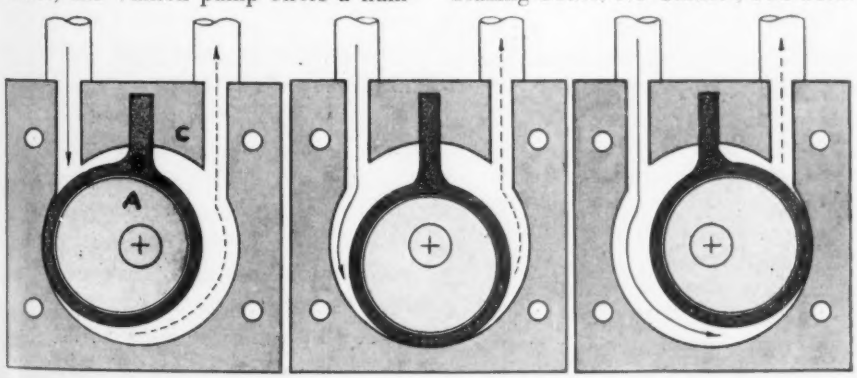
No Check Valves, No Glands or Stuffing Boxes, No Gaskets, Self Priming, High Vacuum, Self Lubricating, Compact Size.

The over-all size of the 120 G.P.H. model is 3¾″ x 4½″ x 2½″.

Ease of Maintenance

By removing four bolts, the "flex-i-liner" can be replaced in less than fifteen minutes. It is not necessary to disconnect pipe lines or any other attached equipment.

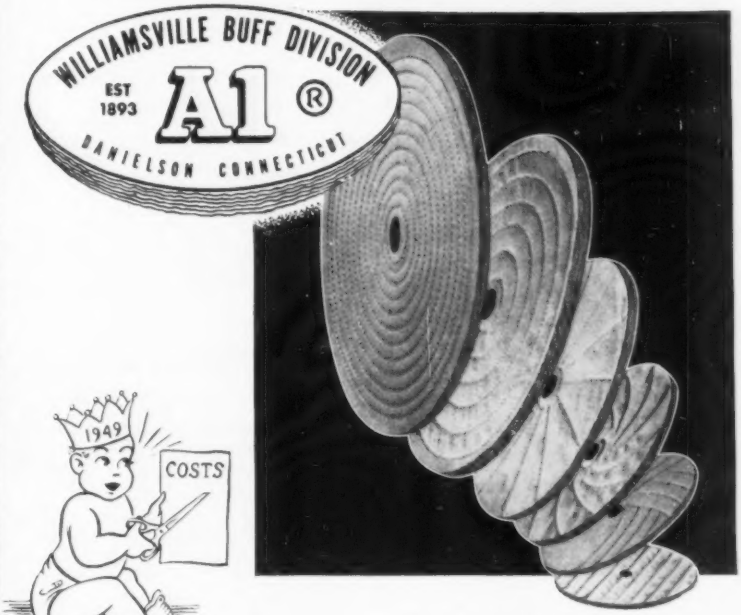
The Vanton Pump Corporation currently is manufacturing a standard model of 120 G.P. Hour. This unit may be obtained, mounted and direct-connected to a ¼ H.P. A.C. motor operating at 1750 R.P.M. Special requirements such as variable speed, explosion proof or completely enclosed motors can be supplied.



Simolified drawing showing principle of operation of the Vanton pump as the Flex-i-liner is actuated by the eccentric rotor shaft. A—Eccentric rotor shaft; B—Flex-i-liner; C—Hard rubber pump body.

CUT COSTS FOR '49

WILLIAMSVILLE BUFF DIVISION
EST 1893 A1 ®
DANIELSON CONNECTICUT



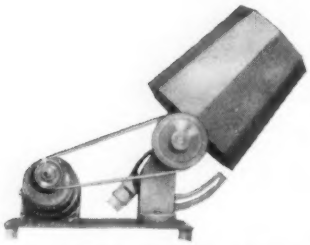
Start with Finishing

Start your profit-and-loss statement off to a Happy New Year by specifying WILLIAMSVILLE BUFFS for all your metal finishing needs. They cut buffing costs to the bone — run cool — pre-faced to eliminate raking. For over a half-century WILLIAMSVILLE BUFFS have performed fast, clean, economical work on jobs of all types. For better buffing — at lower cost — write, wire, or phone!

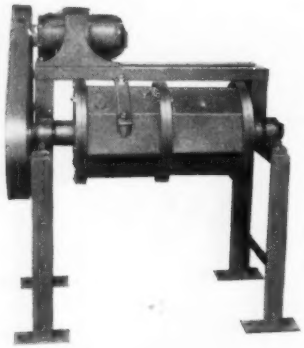
WILLIAMSVILLE BUFF DIVISION
The Bullard Clark Company
DANIELSON, CONNECTICUT

ON SMALL JOB LOTS

FINISHING COSTS TUMBLE



TILT-TYPE BENCH MODEL — motor or belt driven. Adjustable elevation. Steel, wood, rubber lined or alloy metal barrels.



HORIZONTAL FLOOR MODEL — light duty for bulk tumbling and burnishing of small parts.

. . . . when you use a Henderson Oblique Tilt-type Bench Model Tumbling Barrel.

Ideal for SMALL-LOT FINISHING and SAMPLE LOT PRODUCTION of jewelry, clock parts and similar products requiring a *quality finish at minimum cost.* Widely used in laboratory experimental work.

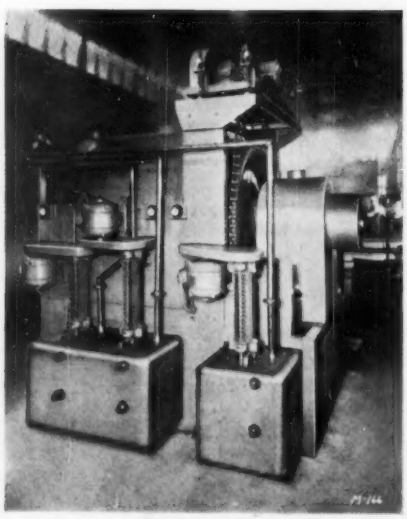
ALSO HORIZONTAL TUMBLING BARRELS — both light and heavy duty for small-lot and quantity production.

Tumbling barrels for every purpose or, made to order to meet your special requirements.

Write now for further information.

Since 1880 Designers and Builders of Tumbling Barrel Equipment.

THE HENDERSON BROS. COMPANY
135 SOUTH LEONARD ST. WATERBURY 85, CONN.



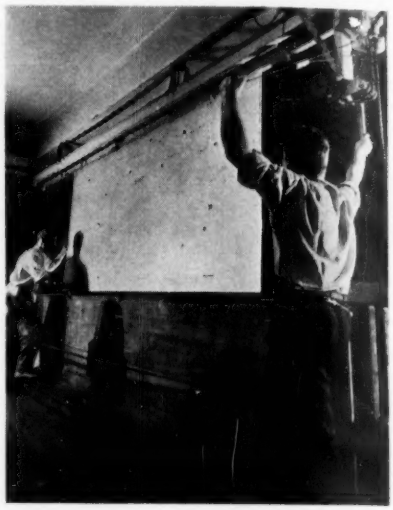
and into a storage tank. The length of each treatment is variable from 0-30 minutes as required for adequate processing. The machine utilizes very little floor space for its output, it is said, and once the parts have been placed into the machine they are not discharged until they are completely treated. All pumps and valves are fully automatic in action, and the cascading action of the parts during treatment is claimed to effect a more efficient and faster cycle. Any desired number of tanks and valves can be incorporated into this equipment, which has a built-in fume exhaust system and automatic timers for each cycle.

Further details may be obtained by writing to the firm at the above address.

Wood Tanks for Photo Developing

Wendnagel & Co., Inc., Dept. MF, 600 W. Cermak Road, Chicago 16, Ill.

A new and unique use for wood tanks in the metal working industries is for photo developing. The photograph shows one step in the development of photographs on metal plates.



This projection method puts engineering drawings, photographs, exact patterns of parts on metal templates.

Wood is highly resistant to decay, has high insulating properties, at low heat conductivity. Wood requires no painting or maintenance. The persistent use of wood tanks in the face of all other developments is an indication of their stable qualities.

Wood tanks and vats are made in all shapes and sizes. Round, rectangular, vertical, horizontal, with or without legs, to meet particular requirements. These tanks are designed by engineers, of tight and accurate construction, properly braced and made of Tank Grade Lumber.

Centrifugal Dryer

Nobles Engineering & Mfg. Co., Dept. MF, 745 E. 3rd St., St. Paul, Minn.

This firm has announced their new centrifugal dryer for small metal parts that can be handled in baskets. The unit is ruggedly constructed for long trouble-free operation, and has an internal suction fan that draws the air through the heating elements in the cover of the machine and then the

mass of spinning parts, drying them quickly. Steam or electric heaters may be used. A foot-operated brake is accessible from the entire working area, and the unit includes a heavy hinged cover and a totally enclosed ball-bearing motor. Baskets up to 12" in diameter and 13" high can be accommodated. Motor is a 1HP 220-440 volt 3 phase 60 cycle 1725 rpm, but other specifications can also be supplied. A V-Belt drive connects the motor to the spinner.

Non-Corrosive Pump

Vanton Pump Corp., Dept. MF, 7308 Empire State Bldg., New York 1, N. Y.

After two years of intensive research, development and practical application in the field, the above firm announces the availability for immediate delivery of its new "flex-i-liner" non-corrosive pump.

This unit is capable of handling successfully the many troublesome solutions involved in plating processes, as it solves the age old problem of contamination of the electrolyte by the elimination of packing. Since the pump avoids any entrapment of air in its lines, it is extremely desirable for agitation purposes. Vanton pumps are also suitable for use with filter units.

What makes the Vanton Pump different is its unique design and simple construction. The fluid is prevented from coming in contact with the metal parts by being confined between the outer surface of the Vanton "flex-i-liner" and the inner surface of the recessed hard rubber body. The Vanton "flex-i-liner" has been so adapted to the pump body that leakage to the metal parts is impossible.

Along with its non-corrosive features, the Vanton pump offers a number of other desirable characteristics, such as:

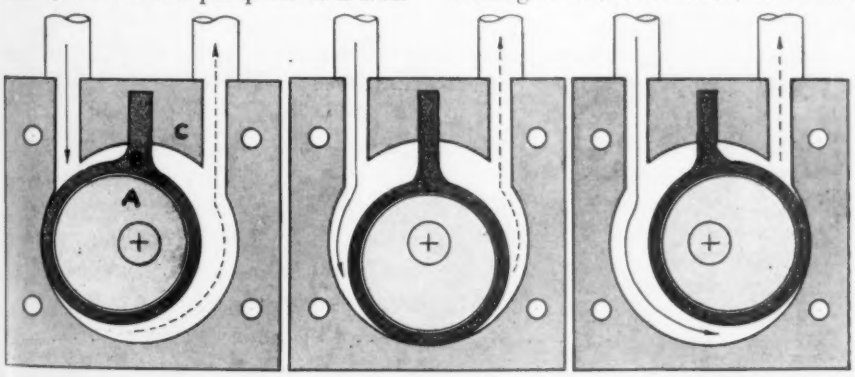
No Check Valves, No Glands or Stuffing Boxes, No Gaskets, Self Priming, High Vacuum, Self Lubricating, Compact Size.

The over-all size of the 120 G.P.H. model is 3¾" x 4½" x 2½".

Ease of Maintenance

By removing four bolts, the "flex-i-liner" can be replaced in less than fifteen minutes. It is not necessary to disconnect pipe lines or any other attached equipment.

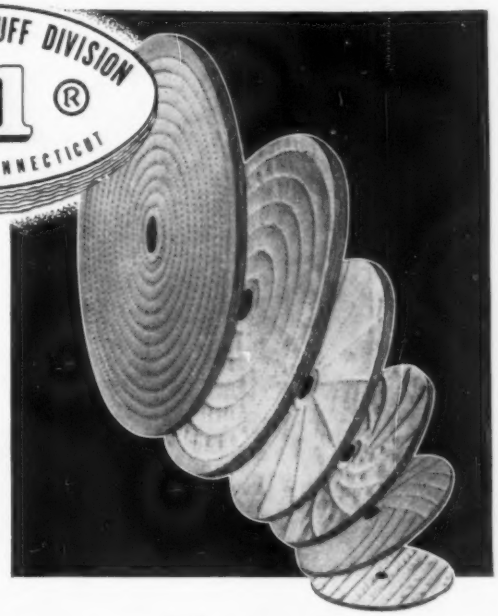
The Vanton Pump Corporation currently is manufacturing a standard model of 120 G.P. Hour. This unit may be obtained, mounted and direct-connected to a ¼ H.P. A.C. motor operating at 1750 R.P.M. Special requirements such as variable speed, explosion proof or completely enclosed motors can be supplied.



Simplified drawing showing principle of operation of the Vanton pump as the Flex-i-liner is actuated by the eccentric rotor shaft. A—Eccentric rotor shaft; B—Flex-i-liner; C—Hard rubber pump body.

CUT COSTS FOR '49

WILLIAMSVILLE BUFF DIVISION
EST 1893 A1 ®
DANIELSON CONNECTICUT



Start with Finishing

Start your profit-and-loss statement off to a Happy New Year by specifying WILLIAMSVILLE BUFFS for all your metal finishing needs. They cut buffing costs to the bone — run cool — pre-faced to eliminate raking. For over a half-century WILLIAMSVILLE BUFFS have performed fast, clean, economical work on jobs of all types. For better buffing — at lower cost — write, wire, or phone!

WILLIAMSVILLE BUFF DIVISION
The Bullard Clark Company
DANIELSON, CONNECTICUT

Reduce your overhead ... effectively control fumes

• The Niehaus method for controlling fumes from your cleaning and plating solutions enables you to save money on fuel, ductwork and purchase price.

The Niehaus Fume Separator controls fumes by the principle of water absorption and centrifugal separation. It has proved so efficient under all shop conditions that many first purchasers already have modernized their plants completely by installing additional Niehaus units.

This Separator allows the entire fume control process to be completed alongside your tanks . . . does away with large, expensive blowers; with costly, space-consuming overhead ductwork. The operation requires no outside enclosures, thus conserving your shop's heat.

The cost of a Niehaus Fume Separator is low. It is easily and inexpensively installed. The savings in ductwork usually will more than pay for the installation. The Niehaus Separator is manufactured in several models with either plain or stainless steel chambers. It is applicable for any size plating installation. Our illustrated folder gives complete information and specifications.

Write for your local dealer's name and address.

INDUSTRIAL ELECTROPLATING COMPANY, INC.
219 West Vermont Street, Indianapolis 4, Indiana

Business Items

Sales Executive Joins Porter-Cable

The *Porter-Cable Machine Co.*, 1714 *N. Salina St., Syracuse, N. Y.*, announces the appointment of *John A. Proven* as General Sales Manager.

Mr. Proven previously held the position of Vice President and Sales Manager of the Sterling Tool Products Company of Chicago, and is well-known in industrial distribution circles. He is a member of the Executive Committee of the American Supply and Machinery Manufacturers Association.

Proven will have charge of sales policies governing the national distribution of Porter-Cable's products which include portable electric tools, floor sanding machines, and abrasive belt grinders. He will also direct the sales efforts of the Unit Electric Tool Company of Syracuse, a division of Porter-Cable.

Mr. Proven has had wide experience in the distribution of industrial tools. He is a graduate of Stevens Institute of Technology and Fordham University.

John A. Proven

Diamond Alkali to Manufacture Perchorethylene

Diamond Alkali Company, a major producer of basic chemicals, has announced its plans to manufacture perchlorethylene, the solvent now in great demand in the cleaning field.

Fred W. Fraley, Diamond's sales vice president, stated that early in 1949 the company would start producing substantial daily tonnage of perchlorethylene at facilities now rapidly nearing completion at its new Houston, Texas plant. The operation will be allied to the company's electrolytic production of chlorine and caustic soda. Diamond has produced carbon tetrachloride at its Painesville, O., plant since 1933.

National output of perchlorethylene, like carbon tetrachloride and trichlorethylene, increased several fold during the war years. Although the wartime uses have declined, the shortage of perchlorethylene has continued because of the number of peacetime applications developed for the product.

While its primary consumption is in dry cleaning, perchlorethylene also finds wide application in degreasing and cleaning metals preparatory to electro-plating, metal-cladding and other surface-finishing operations. It also is used in various steps of fabrication, due to its high solvency for such materials as slushing compounds, cutting oils, die lubricants and other machining and fabricating oils, waxes and gums.

Wilson Supply Co. Moves to New Location

The *Wilson Supply Co.*, formerly of 1935 Euclid Ave., Cleveland, is now located in their new quarters at 2218 *East* 39th *St., Cleveland* 15, *Ohio.*

New Plating Rack Company

Mr. E. L. Faulman, President of National Rack Company, Inc., Fair Lawn, N. J. announces the appointment of *L. D. Faulman* as executive manager of a new rack company to be established in Flint, Michigan, under the name of the *Imperial Plating Rack Company*, 800 *Industrial Ave., Flint, Mich.*

L. D. Faulman

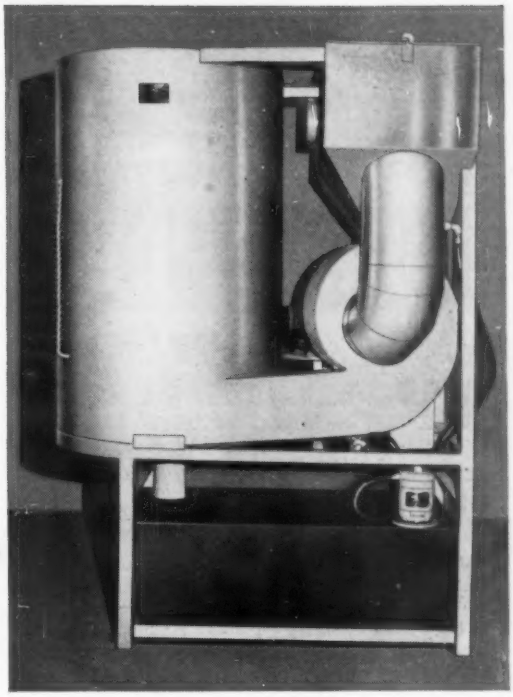
Mr. L. D. Faulman was formerly sales manager of National Rack Company, Inc. and has a wide background in the engineering, sales and manufacturing of all types of plating racks. He has a keen knowledge of the individual requirements of manufacturers and electroplating processors and has had the satisfaction of serving and satisfying numerous Eastern concerns. Mr. L. D. Faulman is a graduate of Michigan State College with a B.S. degree, and in the practical field has spent time with the Michigan Bell Telephone Co. in the electronics division.

The Imperial Plating Rack Co. will engineer and manufacture all types of plating and anodizing racks, featuring a new "Jiffy Tip" which will be removable and replacable. Insulation is guaranteed and has been approved by all major suppliers of plating solutions.

NIEHAUS

Dust Separators

Wash the Air



The new Niehaus Dust Separator is a complete, easily installed unit that utilizes water action to cleanse the air in your shop of dust and foreign particles produced by polishing, buffing and grinding.

Placed adjacent to machines being exhausted, the Niehaus Dust Separator, by high centrifugal action, thoroughly mixes atomized water with dust-laden incoming air and washes out the entrained foreign matter.

The refuse thus collected goes into a portable tank in the bottom of the unit. The cleansed air discharges into the room from the top of the machine. This conserves your shop heat, vented into the out-of-doors by conventional systems.

The new Niehaus Dust Separator combines low first cost and easy maintenance with the ability to handle a variety of loads at constant efficiency.

Niehaus Separators are distributed by local representatives throughout the United States. Your dealer's name will be supplied upon request.

INDUSTRIAL ELECTROPLATING COMPANY, INC.

219 West Vermont Street, Indianapolis 4, Indiana

Two Thousand Gallons Per Minute of Absolutely Pure Water Produced by Manhattan Rubber Lined Equipment

Fifteen tanks and large quantities of pipe and fittings were recently rubber lined by *Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J.* The shipment consisted of seven cars, enough for a good trainload.

This rubberized equipment forms the nucleus for the largest fully automatic demineralizing and silica removal plant in the world.

Water from Lake Huron at atmospheric temperature is passed through the plant at the rate of two thousand gallons per minute. All the impurities and mineral solids are removed so that the water leaving the plant is equal to distilled water quality, it is claimed. The pure water is used to supply 1400 lb. per square inch to boilers which generate electric power for one of the largest midwest chemical companies.

They were the largest tanks that could be shipped by rail in one piece from Manhattan, where they were rubber lined. Five of these tanks on three flat cars were too large to be shipped from Passaic and had to be trucked to Paterson for rail shipment.

A model installation of the gigantic water conditioning plant showing Manhattan's rubber lined tanks is on dis-

Now You Can Have Highest Test Pure Water for Plating at only 5¢ per 1000 gallons!

NEW BARNSTEAD

UPFLO Demineralizers

Have 3 Important Advantages

1 New Efficiency Lowers Cost per Gallon
The combination of improved synthetic resins and the UPFLO method of operation result in much higher purity and at the same time lower operating costs. Depending on the amount of minerals to be removed from the raw water this may well be as low as 5¢ per 1000 gallons.

2 Regenerating Time Cut Nearly in Half
Another advantage of UPFLO operation is that "backwashing" is entirely eliminated. This important saving in labor represents a considerable reduction in operating costs and further reduces the cost of the water.

3 Package Unit — Easy to Install
Barnstead UPFLO Demineralizers come completely assembled with all inter-connecting piping, gang-operated valves, and built-in regenerating tanks. They are compact, efficient units, ruggedly constructed with handsome stainless steel cabinets and console type control panels. They need only be connected to raw water supply and waste to start operating. Ready for immediate delivery. Send for Bulletin 117 and prices.

FIRST IN PURE WATER SINCE 1878

235 Lanesville Terrace — Barnstead STILL & STERILIZER CO. Inc. — Forest Hills, Boston 31, Mass

George C. Delp

Mountville, Penna., maker of heavy industrial and quarry equipment, and the New Holland Metals Company, Mountville, Penna., fabricator of aluminum products.

Mr. Delp is also president and general manager of the New Holland Machine Division of The Sperry Corporation; vice-president of Hertzler & Zook Division of Sperry, Belleville, Penna., an executive partner in State Equipment Company, Harrisburg and Kingston, Penna.; and a director in Lustron, Inc., Cleveland, Ohio; Vulcan Machine Company, Waynesboro, Penna., and Dellinger Manufacturing Company, Lancaster, Penna.

He is a member of the industrial capital committee of the National Association of Manufacturers and the American Society of Agricultural Engineers.

play in the entrance lobby of the Belco Industrial Equipment Division, Bogue Electric Company, Paterson, N. J., designers and manufacturers of the equipment.

New Plant of Victor Chemical Works Now in Operation

The starting of operations at Victor Chemical Works' new Morrisville, Penn. plant, was announced recently. This increases the number of plants operated by Victor to five, and is the second to be completed in its post-war expansion program.

The new plant will produce phosphoric acid and other phosphate compounds, and is strategically located to supply consumers in the East and on the Pacific Coast. The plant is under the supervision of *E. L. Conant*, Superintendent. Mr. Conant was formerly an Assistant Superintendent of the Company's Chicago Heights plant, and is now a resident of Morrisville.

Delp Elected Sperry Vice-President

George C. Delp, president of the *New Holland Machine Co.*, New Holland, Pa., has been elected a vice-president of The Sperry Corporation, according to *Thomas A. Morgan*, chairman of the Sperry Board of Directors.

The New Holland Machine Company is a subsidiary of The Sperry Corporation since September, 1947. Divisions of New Holland include the New Holland Manufacturing Company,

Titeflex Appoints Sales Agents for Western Penna. and W. Va.

Titeflex, Inc., 500 *Frelinghuysen Avenue, Newark* 5, *N. J.*, announces the appointment of *Manufacturers Sales Agency*, 523 *Brushton Avenue, Pittsburgh* 21, *Pa.*, as exclusive sales agents for Titeflex products in Western Pennsylvania and West Virginia. The agency will sell the complete line of Titeflex products, including all-metal flexible tubing, industrial filters, high frequency leads, waveguides, and lubricator valves for central line lubrication.

Mr. Lewis Detch is manager of Manufacturers Sales Agency. Associated with him are *N. Chirumbole, Herbert Jones, and Roy Evissel.*

Industrial Filter Forms Ion-Exchange Division

Industrial Filter & Pump Mfg. Co., 1021-39 *W. Carroll Ave., Chicago* 12, *Ill.*, has recently established an Ion-Exchange Dept. to furnish Industrial Demineralizers to the plating industry, thus providing the industry a means of purifying water very inexpensively.

For twenty-one years this company has served the plating industry in filtration of solutions, salt fog corrosion testing equipment and, more recently, complete service in rubber linings and coatings for tanks, pipe, valves and fittings.

The addition of ion-exchange equipment brings further service in the field of clarification and purification to the chemists and platers. Ion-exchange resins, now available for removing soluble minerals from water, plus our experience with removal of silt and sediment by clarification filters and our engineering experience in construction of rubber-lined equipment add another Industrial service for better electroplating.

Mathieson Appoints New Sales Manager

Harry P. Smith, formerly New York District Sales Manager of *Mathieson Chemical Corp.*, 60 E. 42nd St., New York City, has been made Assistant General Manager of Sales, it is announced by *E. E. Routh*, Vice President and Director of Sales. His headquarters will remain in the company's New York offices.

A native New Yorker, Mr. Smith graduated from Columbia with a B.S. degree in 1921. Prior to joining the Mathieson sales department in 1944, he was President of the *George Chemical Company*, now a division of Diamond Alkali Company. He is a member of the Chemical Salesmen's Association of New York and Alkali Distributors of the New York Metropolitan Area.

Harry P. Smith

Detrex Appoints New Controller

Mr. R. A. Emmett, President of the Detrex Corporation, Detroit 32, Michigan, has just announced the appointment of *Garrett C. Van de Riet* as Controller.

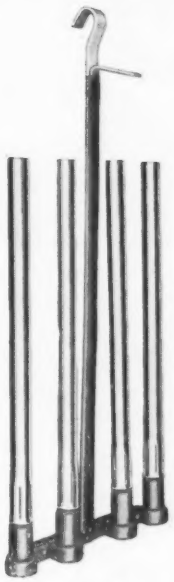
Mr. Van de Riet, who has been with Detrex for the past six years, has been on special assignment in the Industrial Equipment, Dry Cleaning, Oil Extraction, and Solvent Divisions of the Company.

Coming originally from Grand Rapids, Michigan, where he was graduated from Calvin College with a Bachelor of Arts degree in Economics, Mr. Van de Riet received his Masters degree in Business Administration from the University of Michigan in 1936. He taught at the University of Detroit, was associated with Parke-Davis Company, and the Treasurers Division of the General Motors Corporation, before joining Detrex.

He is a member of the National Office Manager's Association; Beta Gamma Sigma, and Phi Kappa Phi national honorary fraternities; and Phi Alpha Kappa fraternity.

ADHESION

PASTE INSULATION MUST HAVE GOOD ADHESION



BUNATOL NO. 1000

is high in quality and low in price. Best for all type racks.

The remarkable resistance and long life of Paste Rack Insulation is to a large extent due to the Primer coat, which provides adhesion.

BUNATOL Primer is a one coat job. A single dip tank and just one labor operation. That means faster work and time saved; plus the saving in actual labor cost.

The Primer does give excellent adhesion to all rack metals. It sticks tight and holds the thick single coat of Paste Insulation down to the rack so there is no seepage or carry over.

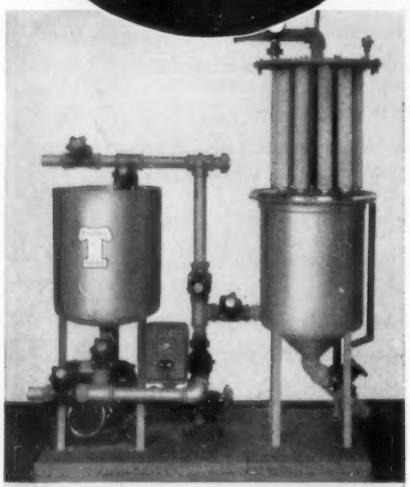
Compare! Even if you are now using a Paste Insulation find out about BUNATOL prices; long life quality; and what can be saved in application labor. If operating costs mean anything in your shop then investigate. Full information, sample and prices are yours for the asking.

NELSON J. QUINN COMPANY

TOLEDO 7, OHIO

BUNATOL

Fast cleaning time



TITEFLEX Filter Model 5A-1000 showing porous membrane.

One of the many economies of the **Titeflex** *Filter*

CLEANING of the TITEFLEX Industrial Filter requires only 7 to 20 minutes, depending upon the size of filter and type of solution being filtered. A new method of backwashing simplifies the entire cleaning process, eliminates waste labor, and completely removes all residue.

Other important savings made possible by the TITEFLEX Filter are:

1. LOW MATERIAL COST—a few cents worth of filter aid serves for each batch filtered. No expensive filter pads or asbestos sheets.
2. LOW LABOR COST—a completely sealed system requiring a minimum of labor.
3. LARGE CAPACITY—3 to 10 times that of the other equipment with equal filtration area.
4. NO LEAKAGE—therefore no loss in expensive filtered material.

If you are looking for a highly efficient filter that will give you sharp, clear filtration at the lowest possible cost, then investigate the TITEFLEX filter. Write for descriptive folder—today.

Titeflex, Inc.

546 Frelinghuysen Ave., Newark 5, N. J.

Exclusive Manufacturers of Titeflex high quality products for more than 30 years

Sales Offices { CHICAGO CLEVELAND DETROIT PHILADELPHIA LOS ANGELES BOSTON SAN FRANCISCO TORONTO

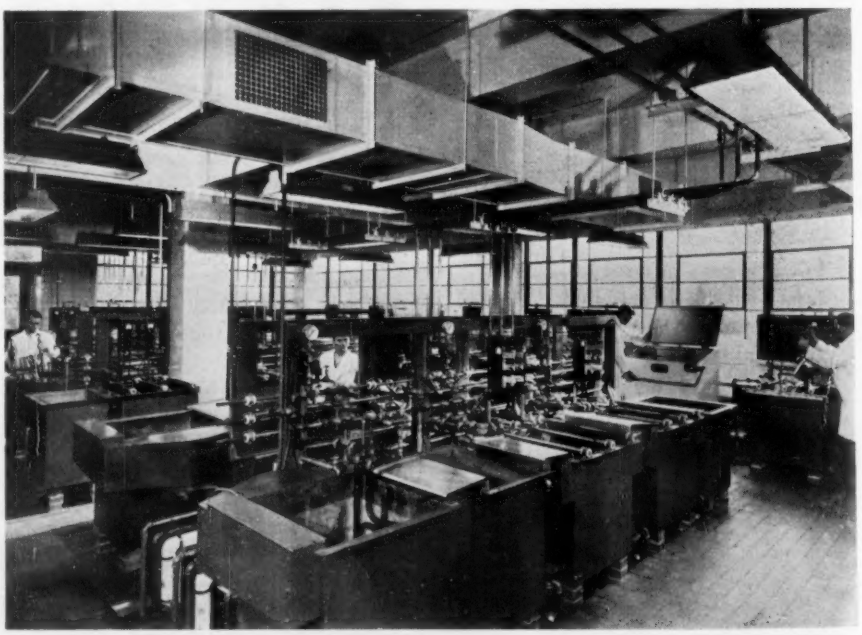
H-VW-M Opens New Laboratory for Research and Customer Service Work

Exterior view of the new laboratory.

The formal opening of the new Hanson-Van Winkle-Munning electrochemical laboratory at Matawan, N. J., shown in the accompanying photo, was celebrated November 17th. In observance of the occasion, representatives of the press, technical societies and prominent individuals in public life were invited from all parts of the country to take part in the opening day program. This consisted of company-conducted inspection tours of the new building, the dedication and a reception on the premises.

The H-VW-M laboratory, with its more than 15,000 suare feet of floor space, contains the most advanced facilities available for research and development, and for helping individual companies in the industry to solve their problems.

Heart of the new three-story laboratory is the plating room on the first floor. Equipment installed here includes complete apparatus for experimental and sample cleaning, pickling, plating and anodizing. Efficiency, advanced instrument control, comfort and safety of technicians, accessibility of services and most important of all, sufficient flexibility in the arrangement of apparatus to permit alterations to meet changing needs, were major considerations in the set-up. The floor is



Partial view of plating room showing standard process tanks and equipment for cleaning, pickling and plating.

covered with acid-proof bricks which are pitched in various directions to the drainage troughs under each line of tanks. Silicon-iron waste lines carry drainage to an outside treatment plant. Overhead, vapor-proof fluorescent fixtures provide uniform lighting for night work, while continuous window areas on two sides combine with highly reflective walls and ceilings to eliminate the need for artificial light during normal daylight hours. A complete air change can be made in the plating room every 1½ minutes, if desired, through ducts that provide cooled air in the summer and warmed air in the winter. Three exhaust blowers and one intake fan keep the room under slight pressure, thus keeping out dust and preventing contamination of plating solutions. Curent is supplied by two DC motor generator sets, one with a 1500 ampere capacity at 6-12 volts and the other a 500 ampere, 40 volt unit. Portable low-voltage rectifiers are available for auxiliary DC current.

A large analytical laboratory on the second floor is used primarily for customers service, involving the analysis of plating solutions and investigating difficulties encountered in the application of electrodeposits. The research laboratory is devoted to the investigation of new products and processes and fundamental studies of problems related to metal finishing. Additional rooms on the floor house a metallographic laboratory, dark room, balance room, and offices.

In the right wing of the second floor is a laboratory for investigating, developing and testing polishing and buffing compounds and materials. A feature of this laboratory is a custom-built, precision buffing machine used for exact valuation of buffing and coloring compositions, as well as for basic research in the field. An intercommunication system closely links the laboratory's 33 rooms.

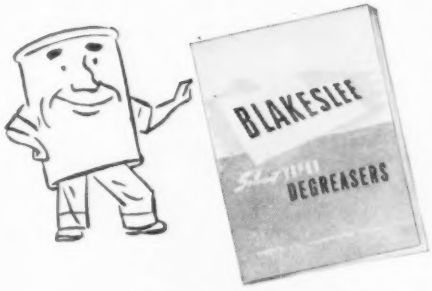
H-VW-M officials expressed the hope that everybody in the industry would visit the new laboratory and that companies in the industry would use the facilities as a pilot plant to determine correct solutions and cycles before changing over to new types of plating jobs. Since several technical societies have already scheduled their 1949 conferences in the new building, a good part of this wish seems well on its way to fulfillment.

CLEAN and SMOOTH

METAL PARTS COME OUT FREE OF GREASE OR CHIPS WHEN CLEANED IN A

BLAKESLEE

SOLVENT *Vapor* DEGREASER



Blakeslee Solvent Vapor Degreasers employ a patented degreasing process . . . parts made of metals and alloys chemically cleaned and dried in only a few seconds . . . no need for subsequent rinsing and drying operations. Oil and grease-free surfaces are obtained, complete oil removal from cracks, pores, seams and hidden crevices of machined parts, stampings, assemblies, etc., is assured. Masses of nested parts are thoroughly cleaned and dried throughout.

In this cleaning process, the oils and greases are dissolved by BLACOSOLV, the efficient degreasing solvent which can be used on all metals or combinations of metals. BLACOSOLV is non-inflammable and non-explosive.

Write today for FREE booklet on Degreasers and applications with Blacosolv, the all-purpose degreasing solvent.

G. S. BLAKESLEE & CO.

BLACOSOLV DEGREASERS AND SOLVENT

NIAGARA METAL PARTS WASHERS

G. S. BLAKESLEE CO., CHICAGO 50, ILLINOIS
NEW YORK, N. Y. TORONTO, ONT.

Cadillac Chemical Announces New Affiliation

Effiective November 1, 1948, the business of Cadillac Chemical Company will be continued as the *Cadillac Chemical Division, Nelson Chemicals Corp.*, 12345 *Schaefer Highway, Detroit* 27, *Mich.*

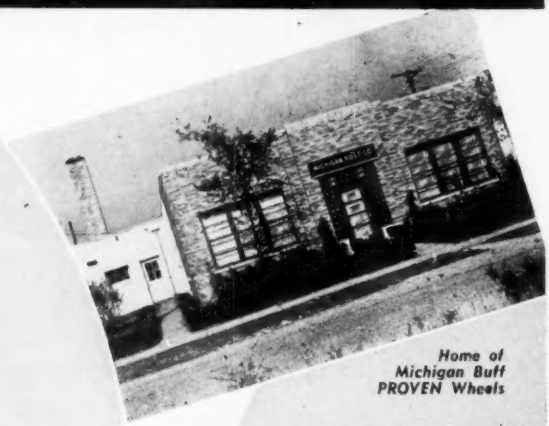
This arrangement will result in considerably improved and expanded facilities to better serve customers, according to the firm.

Wyandotte Chemicals Purchases Absorbent Mineral Deposit

E. M. Ford, president of the Wyandotte Chemicals Corp., Wyandotte, Mich., announces the acquisition of the manufacturing facilities and clay deposits of Blue Mountain Clay Company, Inc., producers of Wyandotte Zorball —the all-purpose oil and water floor absorbent.

Acquisition of the Mississippi property is in line with Wyandotte Chemi-

Michigan Buff "PROVEN" WHEELS



Home of Michigan Buff PROVEN Wheels

- Each buff balanced before glueing into wheel
- Made from only the best new material
- Available in any and all sizes
- Made in any densities wanted (soft—medium—hard)
- Every wheel guaranteed to run true and to be in perfect balance
- All Michigan Buff wheels are made under supervision of men of 20 years experience

Top quality new materials and modern manufacturing facilities make Michigan Buff Polishing Wheels the quality wheel of PROVEN, long-lasting performance. Your inquiries are invited!

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REPRESENTATIVES WANTED . . . plating supply houses . . . acid and chemical companies preferred. A few select areas available. Write for details.

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cals policy of controlling basic raw materials that are used in manufacturing—thus insuring continued high quality and constant supply of Wyandotte products.

Zorball is marketed under the direction of *C. B. Robinson*, vice-president of sales of the J. B. Ford Division of Wyandotte Chemicals. The Company's national distribution system, consisting of salesmen, jobbers and numerous warehouse stocks, puts Wyandotte Zorball within easy reach of all users.

The unique characteristics of Zorball account for its already-high consumer acceptance, according to the firm. The absorbancy is due to capillary action in channels within the highly porous structure. More important, the granules never soften or turn to a slippery mud in oil or even when completely saturated with water, it is claimed. The valuable non-slip property of Zorball is ascribed to its very low content of calcium and magnesium oxides.

Charles E. Campbell Joins H-VW-M

The *Hanson-Van Winkle-Munning Company, Matawan, N. J.*, announces the addition of *Charles E. Campbell* to their sales force.

Mr. Campbell is a graduate of the University of Toledo. Before coming to H-VW-M, he was assistant to the chief chemist at the Gordon Manufacturing Co., of Toledo, Ohio. He has had substantial experience in the electroplating field, including production, analytical and control work and trouble shooting.

Charles E. Campbell

Mr. Campbell will make his headquarters in the Detroit office of the Company.

Michigan Abrasive Moves to New Quarters

To take care of its fast-growing business, the *Michigan Abrasive Co.* recently moved its complete fabricating facilities and general offices into two new buildings at 2360 *W. Jefferson Ave., Detroit, Mich.*

All fabricating operations are installed in the new plants, including new high capacity ovens for manufacturing resin-bonded industrial abrasives. The Company's executive and general offices also were moved to the new quarters in order to take care of increased executive, technical and sales personnel, Mr. Max C. Jones, Company President pointed out, and all the Michigan abrasive-making equipment and operations will continue in the company's old plant at 1111 *Bellevue Ave.* Formal opening of the new plants was celebrated October 29 with an Open House where customers and friends inspected the new high capacity ovens and other fabricating equipment between refreshments, dinner and entertainment.

Max C. Jones

"We don't know how long this extra 30,000 square feet of floor space is going to last us," Mr. Jones told his guests at the celebration. "The way our business has pyramided, we may be entertaining you in other new plants a year or two from now."

Other Michigan Abrasive officers present at the Open House included *Frederick P. Hauck*, vice president in charge of manufacturing; *C. H. "Fid" Wills*, general sales manager; *Louis F. Guetschow*, assistant secretary-treasurer, and *Robert O. Blackford*, advertising and sales promotion manager.

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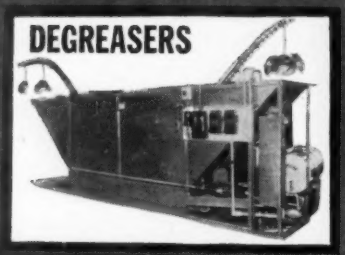

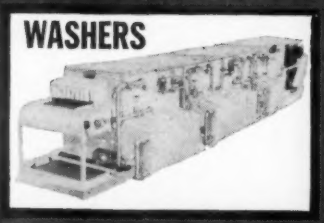

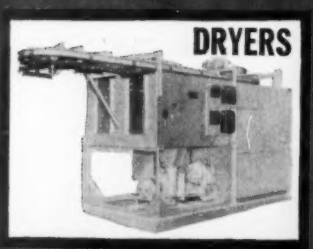

A complete line of OPTIMUS Equipment is available in standard and special sizes to meet every metal parts cleaning problem and allied processing applications.

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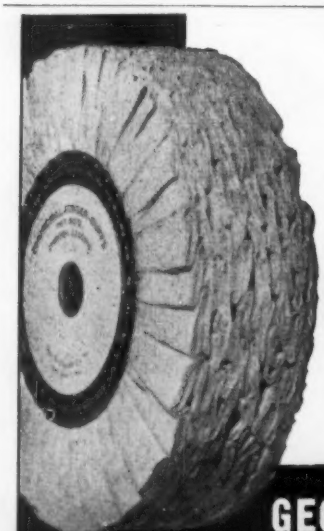

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Under U. S. Patents Nos. 2146284, 2350216. Others Pending.

New England Silversmiths Change Address

New England Silversmiths, formerly at 304 East 59th Street, have opened a new store and factory at 900 *Third Avenue* (Between 54-55th Sts.) *New York* 22, *N. Y.* They are makers of fine sterling silver and plated-ware.

New Plating Supply Firm Formed

The *Imperial Plating Supply and Equipment Co.*, with headquarters at *Warren Point, N. J.*, has been formed to meet the increased demands in this territory for efficient handling of customers' needs for plating and polishing supplies, rack coatings, and general equipment. A complete line of the best known products in this field will be available, according to *Mr. Edward Faulman*, president of the firm.

Manufacturers' Literature

Free, valuable information on equipment and processes. Write to the manufacturer and department listed for your copy.

Semi-Automatic Polishing and Buffing Machines

Acme Mfg. Co., Dept. MF, 1645 *Howard Ave., Detroit* 16, *Mich.*

A bulletin just issued by the above firm describes the complete line of production type automatic buffing and polishing machines manufactured by them. A wide range of equipment is available to handle almost every conceivable shape of part, from small flat work to deep objects such as pots and lamp bodies on a high-production basis. Other machines handle long tubular parts, reveal moldings, and screw heads. Free copies of this bulletin may be obtained from the above firm.

Special Industrial Protective Coatings

United Chromium, Inc., Dept. MF, 51 *East* 42*nd Street, New York* 17, *N. Y.*

New, 4-page bulletin on UCILON Protective Coatings introduces latest developments in well-known line of corrosion-resisting materials. In iden-

tifying each coating and its proper application, this bulletin points out how, as a component in a "system" of coatings, each makes its special contribution towards greater corrosion resistance and a longer lasting job.

Typical case-histories are presented, in evidence that such specialized coating systems provide an answer to many serious corrosion problems.

Surface Active Agents

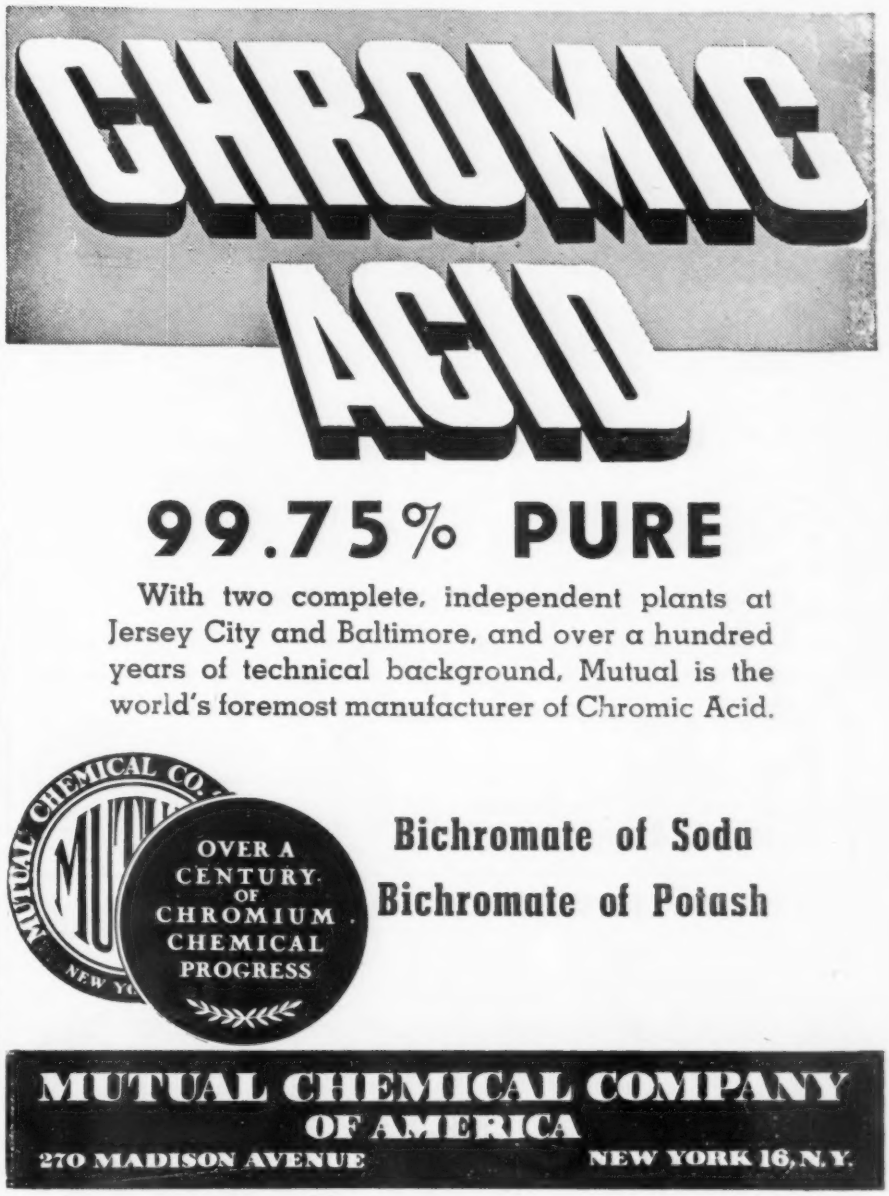
Alrose Chemical Co., Dept. MF, 180 Mill St., Cranston, R. I.

A booklet published by this firm lists their line of wetting and surface active agents for the metal finishing industry, particularly Sequestrene. It is claimed that this material retains its stability at high alkalinities and high temperatures, and is particularly useful in preventing the precipitation of colloidal substances in silicate cleaners, and preventing the precipitation of calcium compounds wherever hard water may be encountered. Booklets describing the material in detail are available on request.

Polishing and Buffing Machines

Standard Electrical Tool Co., Dept. MF, Cincinnati 4, O.

A new bulleting published by this firm gives detailed specifications on their line of Cadet grinders, buffers and polishers in sizes from ¼—7½ H.P. Single and two spindle models are available, with or without hand brake and variable speed control. Both bench and pedestal models are included in this line of equipment. Write for Bulletin 112.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Grinding and Polishing Flat Stock Automatically

Central Machine Co., Dept. MF, Worcester 8, Mass.

A machine developed by this company for grinding and buffing flat stock is the subject of a bulletin issued recently. In operation the work is suspended on hangers or magnetic plates and moves down through two rotating rolls, oscillating back and forth while moving vertically. Operation is entirely automatic, leaving the operator free to load and unload fixtures while parts are being finished. This type of machine is claimed to be particularly good for polishing and grinding knife blades, flatiron bottoms, and similar items. Rolls are adjustable for distance apart, parallelism, and speed, and are said to be easily changed to renew the abrasive medium. Either one or two sides may be finished simultaneously. Copies of the bulletin are available by writing to the above address.

Air Actuated Temperature Controllers

Leeds & Northrup Company, Dept. MF, 4934 Stenton Ave., Philadelphia 44, Penna.

A complete, air-actuated control system of advanced design is presented in a 24-page, well-illustrated catalog ND4B just issued by this firm. The equipment described in this publication is said to be enabling users in the chemical industries to obtain faster start up, smaller process swings, no process drifts, longer on-stream runs, faster recovery from upsets and shorter turn-around time.

Diagrams and test curves show how this system provides not only: (1) proportional action and (2) automatic droop-correction (reset), but (3) stabilized rate action as well. Full-size photographs show the machine-like construction of the control mechanism. Other pictures show interesting and significant design features. Also illustrated is the simple, rapid method used by the operator to switch from manual to automatic control or vice versa—without causing any "bump" in process operation.

Fewer operations . . more production
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COMPRESS
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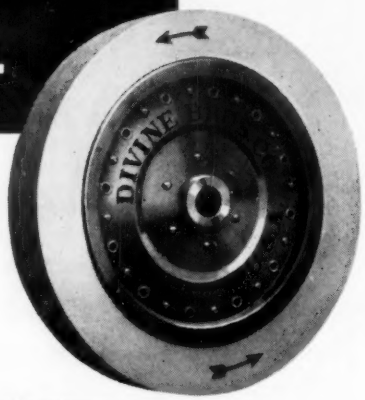

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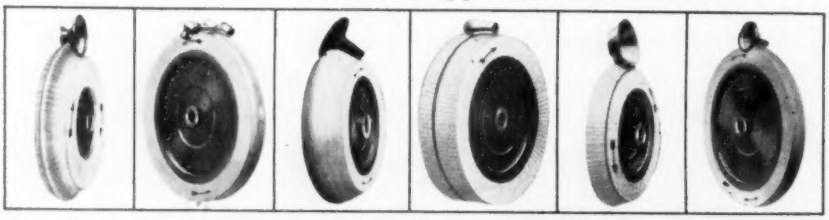

The Compress Polishing Wheel is only one of many Divine products — Buffs, Polishing Wheels, Contact Wheels, Lathes, Automatics, and hundreds of other items! It's Divine for *the complete line!*

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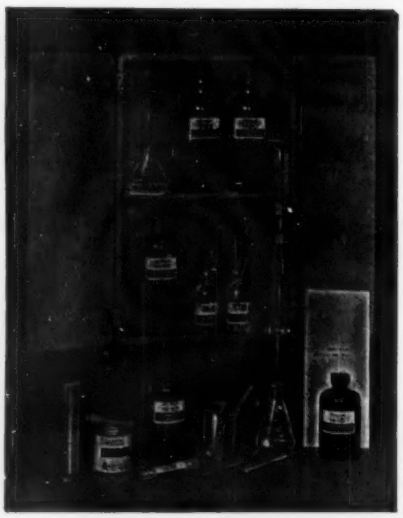

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Simple test sets for controlling these and other solutions available.

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Readers will find in this catalog a complete line of L&N controllers . . . round chart or strip-chart models . . . Speedomax for regulating unusually fast-changing temperatures; Micromax for regulating all other temperatures, electrolytic conductivity or pH.

Dust and Fume Control Equipment

Schmieg Industries, Dept. MF, 300 Piquette Ave., Detroit 2, Mich.

Two new catalogues, Nos. 480 and 481, are announced by this firm, engineers and manufacturers of plant equipment.

Catalogue 480 describes the Schmieg Centri-Merge Spray Booths for the elimination of paint overspray, with photographs and blueprint reproductions of typical plant installations.

Catalogue 481 offers comprehensive information concerning equipment manufactured by Schmieg, including dust and fume control units, spray booths, mechanical washers, industrial ovens, and sheet metal equipment and accessories. Tables of Technical information for plant managers and engineers are included.

Copies of the catalogues may be obtained free of charge on request.

Bulletin on Dust Control

The W. W. Sly Manufacturing Company, Dept. MF, 4700 Train Avenue, Cleveland, O.

This new Bulletin No. 98 contains information on the basic principles which apply to the control of dust in industrial plants, tells how to attack a dust problem, and contains engineering information, including dimensions and capacities of Sly dust filters.

These filters operate on the principle of multiple vacuum cleaners, with a number of filter bags in proportion to the required capacity. The air after passing through a filter is clean and free from dust. The Bulletin lists over a hundred different kinds of dusts which are collected by these filters.

All processes which produce any kind of material in powdered form create a dust which in many instances would be an economic loss if not collected. Many other advantages of the control of industrial dusts are pointed out.

The Bulletin is profusely illustrated with views of a number of typical installations in various industrial fields. Copies are available on request.

Overcoming Corrosion By Salt and Salt Solutions

International Nickel Co., Dept. MF, 67 Wall St., New York 5, N. Y.

The part played by corrosion control in the production of salt, and in the use of brine solutions by chemical and food processors, is described in a new 20-page booklet entitled "Salt As a Corrosion Problem" just issued by the above firm.

The booklet contains a minimum of ancient history. Its contents are about equally divided between a discussion of corrosion problems solved by the salt industry, and equipment for handling brine solutions in the chemical and process industries.

The American salt industry, with its high-purity requirements and low bulk prices, represents one of the major triumphs of chemical engineering science, but salt production was an old and basic industry long before chemical engineering was dreamt of. One reason for this apparent technical paradox is the alertness of modern salt producers to study and apply new engineering methods, and to adopt suitable equipment after test.

This publication is available without charge.

Brush Plating Equipment

Ajax-Consolidated Co., Dept. MF, 4615 W. 20th St., Chicago 50, Ill.

A new booklet issued by this firm describes their line of equipment and supplies for brush plating. In addition to the portable power supply and rectifier, a complete line of brushes, anodes, and chemicals are available for brass, bronze, cadmium, copper, gold, lead, nickel, black nickel, silver, tin, and zinc plating. Cleaning and polishing materials are also a part of this equipment. The booklet describes various applications where brush plating has provided the answer to difficult problems. Copies of the bulletin are available upon request.

Automatic pH Control

Brown Instrument Co., Dept. MF, Wayne & Roberts Aves., Phila. 44, Pa.

pH and conductivity control and their application to different industrial processes is a feature of the new catalog published by the above firm. Typical examples presented include pH control in heavy chemical industries, agricultural chemistry, electroplating,

The PERMAG Folks

—extend to friends, customers, everyone Best Wishes and Greetings of the Season.

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ANNUAL EDUCATIONAL SESSION AND BANQUET

NEWARK BRANCH—A. E. S.

DECEMBER 18, 1948

HOTEL ROBERT TREAT, NEWARK, N. J.

SPEAKERS:

A. W. LOGOZZO, Nutmeg Chrome Corp.
Bright Nickel and Decorative Chrome Problems

F. OPLINGER, E. I. Du Pont De Nemours and Co.
Copper Plating

DR. E. M. WISE, The International Nickel Co.
Plating of Precious Metals

EDUCATIONAL SESSION 2 P. M. BANQUET 7 P. M.

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SPECIAL: Harrison has developed a new dip compound that creates a head on the buff. You get a deeper cut . . . use less compound . . . save!

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pulp and paper, research, food and steel industries; conductivity control in water treatment, power plants and the textile industry.

Catalog No. 15-12 also offers a discussion of the fundamentals of pH, oxidation-reduction potential and conductivity and describes various instruments such as the ElectroniK Potentiometer, Flow Electrode Assembly, the Beckman pH Amplifier, as well as electrodes, conductivity cells, control valves, motors and pneumatic control accessories.

Fully illustrated with photographs and schematic drawings, "pH and Conductivity" includes in its 43 pages a partial list of circular and strip charts and scales and dimensional diagrams of pH equipment.

A copy of Catalog No. 15-12 will be sent to readers upon request.

Filters and Filter Pads

F. R. Hormann & Co., Dept. MF, 186 Joralemon St., Brooklyn 2, N. Y.

This company has issued a bulletin describing their plate-type filters and filter pads in various sizes, portable mixers, and cylinder type units. Copies of the bulletin are available on request.

Filters for Plating Processes

Niagara Filter Corp., Dept. MF, 3080 Main St., Buffalo 14, N. Y.

A 16-page bulletin by this firm illustrates and describes the Niagara line of process filters for the chemical field in sizes from 10 to 250 gallons per minute. All types of materials are used in the construction of these filters, including rubber-lined tanks where necessary. The unique properties of Niagara filters are said to be dependent upon the rugged and self-cleaning type of leaves used, which contain no soldered joints and are reinforced around the entire edge, thus giving long trouble-free life. Bulletin G-447-50M.

Plate Type Heat Exchangers

Walker-Wallace, Inc., Dept. MF, 1370 Main St., Buffalo 9, N. Y.

A general specification and data sheet describes the company's line of plate-type heat exchangers that can be used for heating or cooling processing liquids. Models are available in various metals, including stainless steel, and standard and easily arranged parts permit expansion of a given sized unit to handle special problems as they arise, it is claimed. A novel feature

of interest to platers is the accessibility of all surfaces when the exchangers are dismantled, making for thorough and economical cleaning and preventing contamination of critical solutions.

Bulletin G-847 available upon request to the above address.

Water De-Ionizers

Ilinois Water Treatment Co., Dept. MF, 884 Cedar St., Rockford, Ill.

Principles of water de-mineralization are described in an interesting manner in the new booklet of the above company. The advantages of using de-ionized water in industrial processes is pointed out, and typical applications are cited. Copies available on request.

Metallizing Equipment

Metallizing Engineering Co., Inc., Dept. MF, 38-14 30th Street, Long Island City 1, N. Y.

The above firm announces a new catalog No. 401 of its complete line of metallizing equipment and supplies.

Since it founding, Metco has aimed at giving the users of metallizing equipment one source of supply for all their metallizing needs. That ideal has now culminated in the printing of this new, useful and easy-to-read eight page catalog.

"The Best of Everything for Metallizing" is the most complete catalog of metallizing equipment, accessories and supplies ever to be offered to industry. In it you will find metallizing guns for every purpose, air and gas controls, spray booths and dust collectors, blast machines and nozzles, and air compressors to give you clean, dry air. Each piece of equipment is clearly illustrated and described. There is also a description of each of the special Metco metallizing wires.

Three new accessories are introduced. (1) A Wire Control and Straightener Unit to increase spraying speeds and reduce wear on your gun. (2) A Gas Flow Meter Unit, the first of its kind, to assure maximum efficiency, higher spraying speeds and greater gas savings. (3) An Air Control Unit that assures you of properly controlled air pressures.

Copies of this catalogue are available on request.

Quality Plating

The following news item was found in the New York *Herald Tribune* recently, and illustrates what we have long suspected regarding the quality of automotive plating of a few years back:

Car Lost 12 Years Found in Thicket

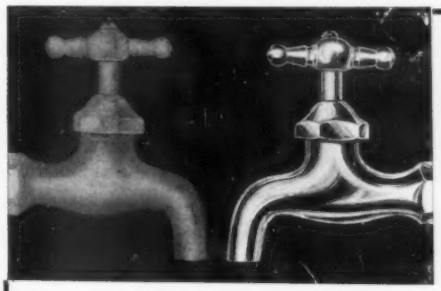
CORPUS CHRISTI, Tex., Nov. 8 (AP).—Palfrey Richter hasn't decided yet what to do with his 1932 model car, lost in the brush on the vast King Ranch of south Texas for twelve years.

It was a slick job that summer day back in 1935 when Mr. Richter and a friend, Glenn Kirkpatrick, took off from work here to go fishing on the ranch. They parked the car, a Chevrolet convertible coupe near the live oak brush and headed off. But when they were ready to go back to the car, "we forgot where we left it," Mr. Richter chuckled. They made a futile search and then gave up.

For twelve years cowhands worked that brush on cattle and hog round-ups twice a year. The live oak thicket kept growing. It was ten feet high when a brush-clearing bulldozer nosed into it last Thursday.

The convertible was a sad sight. Its chassis was resting on the sandy ground. The wheels were half buried in the sand. The cloth top and its wooden struts were rotted and gone. So was the upholstery. But the tires still had air and the *chromium was shining.* (Italics ours.)

It would be interesting to know just how much chrome and underplating there was on this particular car. Anyway, our hats are off to Chevrolet.



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Eliminates Color Buffing—Re-Cleaning—Re-Racking.
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Uniform results obtained on all classes of work in still tanks or mechanical barrels. Excellent for zinc die-castings. Your present cold or lukewarm nickel solution will, with the addition of LUSTREBRIGHT, produce brilliant, lustrous, adherent deposits. Guaranteed not to harm plating solution. Will not cause plate to peel, become brittle, or produce streaky deposits. Illustration shows unbuffed deposits produced before and after addition of LUSTREBRIGHT. Write for complete information.

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We specialize in LIME (White) FINISH and GREASE STICK

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Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Newark Branch to Hold Annual Educational Session and Banquet

The Newark Branch of The American Electroplaters Society will hold their Annual Educational Session and Christmas Party at the Hotel Robert Treat, Newark, N. J. on December 18, 1948. The Educational Session will begin at 2 P.M. Speakers and their Subjects are as follows:

A. W. Logozzo, Nutmeg Chrome Corp. —"Bright Nickel and Decorative Chrome Problems."

F. Oplinger, E. I. DuPont DeNemours and Co.—"Copper Plating."

Dr. E. M. Wise, The International Nickel Co.—"Plating of Precious Metals."

The Banquet will start at 7 P.M.

Baltimore-Washington Branch

The November meeting of The Baltimore-Washington Branch was held at The National Bureau of Standards on Nov. 9th.

Mr. C. R. Fischrupp of the Hawthorne Works of the Western Electric Company gave a very interesting talk on *"Current Industrial Methods of Plating Zinc, Nickel, and Chromium, Using Automatic Equipment."* Illustrating his talk with slides and exhibits, Mr. Fischrupp gave a very clear and informative discussion of the plating equipment and procedures used at Hawthorne. He discussed such things as the advantages of the automatic equipment, storage of the plating baths, procedure of periodically cleaning out the plating tanks, re-use of rinse water, and use of mixing tanks and heat exchangers. An interesting method of inspection and sampling was described. Barrel plating equipment, sources of current, magnetic racking, and laboratory equipment were also described along with the plating conditions and cycles for zinc, nickel, and chromium.

The audience was obviously pleased with the talk and gave Mr. Fischrupp a big hand.

Rochester Branch

The regular monthly meeting of the Rochester Branch of the AES was held at the Hotel Seneca, Friday, October 15. *President Robert Flint* called the meeting to order at 8:30 P.M.

Three new applications for membership were received.

A discussion was held on a Christmas Party and *Mr. Ray Berghold* was elected chairman for the affair which will be held on Saturday, December 18. The place will be announced at a later date.

Mr. A. J. Chandler of the Osborn Brush Co. gave a talk on *"The Use of Brushes in Metal Finishing."* Mr. Chandler illustrated his talk with slides and also had samples of various jobs which had been finished with brushes as well as samples of various types of brushes manufactured by his company.

Los Angeles Branch

G. Stuart Krentel, Pacific Coast manager of *MacDermid, Inc.*, headed the educational session program of the

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November 10th meeting of Los Angeles Branch of the American Electroplaters' Society with an informal talk on bright copper plating.

Mr. Krentel discussed the general subject of bright copper plating, methods of equipment installation and types of solution. He also offered suggestions on good operation and types of treatment and purification. He outlined the application of solution agitation, the use of periodic reverse and anodic diaphram compartments in plating solutions. Purification and filteration were also dealt with in a talk that gave the AES members a well defined presentation of good practice in copper plating work.

A 40-minute period at the conclusion of the talk was devoted to questions from the floor, in the course of which Mr. Krentel proved himself a thoroughly qualified man on the subject of bright copper plating by supplying the answers to some dozen or more questions.

Allie Sulzinger, first vice-president of the branch, presided at the business session in the absence of President Frank Bunker. Sulzinger's business-like handling of the meeting indicated that the branch presidency will be occupied by an equally competent successor when Mr. Bunker's term expires next April. Sulzinger, incidentally, would be the first plater to head the branch for quite a while, the chair for the past three or four years having been occupied by leading chemists or sales engineers of Pacific Coast supply firms, or western representatives of eastern or middle-western houses. Their fine leadership of the branch will give the next active-plater president something to shoot at.

Reporting for the annual Educational Session committee, Chairman *Howard Woodward* announced that the location for that affair had been definitely determined by the conclusion of arrangements with the Los Angeles Breakfast Club.

It was also reported that a favorable acceptance is being recorded by the industry to the branch's project for publishing a combination Program and Directory in connection with the 1949 Educational Session. Plans call for making the 1949 edition better in both exterior appearance and in the content of technical data and plating and chemical formulae than the edition issued in 1945. Much information on plating data, solutions and chemical formulae that were still covered by war-time prohibitions in 1945, will be available for inclusion in the 1949 edition of the directory, it was reported.

G. Stuart Krentel, chairman of the badge committee appointed at a previous meeting, reported that a supply of member identification badges had been purchased. These will be available at the December meeting, at which each member will be able to blossom forth with his name and company affiliation attached for all to see on his coat lapel. A supply of badges, with removable cards, has also been acquired for use by guests.

News that Los Angeles has definitely been assigned the 1951 38th annual convention of the A.E.S. was received with elation and the expression of renewed determination to justify this vote of confidence by the Supreme Society. *Don Bedwell*, who last month was named general chairman of the national convention committee, was not present at the November 10 meeting to report on what preliminary preparation steps had been planned.

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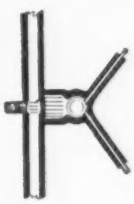

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Chicago Branch
Educational Session

The Chicago branch of the American Electroplaters' Society will hold its annual education session and banquet on January 15, 1949, at the Stevens Hotel.

The speakers and their subjects will be:

1. Corrosion: Enemy of the Plating Industry, *Dr. H. J. McDonald* of Illinois Institute of Technology.
2. Leveling of Electro Deposits, *Myron B. Diggin*, Hanson-Van Winkle-Munning Co.
3. The Evaluation of Polished Surfaces, *Dr. H. L. Kellner*, Lea Mfg. Co.
4. Deep Sea Diving in a Plating Cell, *William Phillips*, General Motors Corp.

An instructive and enjoyable afternoon and evening is promised.

Twin City Branch

The Twin City Branch of the American Electroplater's Society met on Monday, October 4th, 1948 at the Lodge Room of the Covered Wagon in Minneapolis. There were thirty persons present.

Dr. Frank Ireland of Brown and Bigelow opened the branch's series of lectures on metal finishing with a discussion on the Principles of Chemistry, Electricity and Electrochemistry. This was the first of the lectures and those present were well pleased with the project.

Following dinner, Branch President Ireland introduced *Messrs. Reuben Ostrom* and *Robert Hawkins* of Hawkins Chemical Co., who were guests.

It was announced that each member would be invoiced an additional two-dollars which was the increase in annual dues voted upon and accepted at the last convention.

The monthly dinner prize was won by *Al Leonard* of Superior Plating and the silver goblet donated by *Al Joyner* of the Silver Shop was won by *Reuben Ostrom*.

After a brief business meeting, *Mr. Paul Felt*, Vice-President of Brown and Bigelow, and one of the members who recently returned from a trip to Europe and the Scandinavian countries, gave a talk on his trip and showed movies which were excellent. Paul was given a round of applause and thanks by those present.

The November meeting, held on November 1st was attended by 35 persons.

The monthly plating lecture was presented preceding dinner. The lecture was given on Copper Plating by *Robert Buckley* of Industrial Chemical & Equipment Co. Following the lecture, there was a round-table discussion on Copper Plating led by *Jerry Weller* of Brown and Bigelow. There was a good turnout for the lecture and it was announced that the subject for the December lecture was "Nickel Plating."

Following dinner, President *Frank Ireland* of Brown and Bigelow, introduced the following guests: *Verne Danielson* of Northern Ordnance, *Charles Crepeau* of Superior Plating, *Harold Longdyke* and *Bob Peterson* of Twin City Chromium Plating and *A. N. Miller* of Detrex Corp.

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The door prizes were won by *Al Joyner*, Sr., and *Ralph Bowman* of The Silver Shop and Superior Plating respectively. The prizes were a billfold and a free dinner.

Norman Morganroth was welcomed into the branch and *E. R. Frost* of E. R. Frost Co., and *Peter Ruehle* of Ruehle Plating Co., were welcomed back as they have both been recuperating from a recent illness.

The speakers for the meeting were: *C. R. Johnson* and *Earl Gothier* of Minnesota Mining and Manufacturing Co., who spoke on "Abrasive Belt Finishing in the Metal Finishing Industry." The talk was very good and greatly appreciated by those present.

NATIONAL ASS'N OF METAL FINISHERS

The Board of Directors of the NAMF met at the Bismark Hotel, Chicago on Oct. 4th for their quarterly meeting. A report on the first national directory of plating and enameling firms was presented showing that the same was enthusiastically received by the members, as well as the U. S. Department of Commerce and all of its field offices, government procurement agencies, automobile manufacturers, large purchasers of job plating, etc. Compilation of information for the new 1949 Directory will begin next month. Publication of the Metal Finishing Manual was confirmed and approved by the Board and it was recommended that all members immediately purchase a copy of defray the cost of the publishing. The Secretary also was authorized to sell these manuals to companies affiliated with the industry at $2.00 each. A report was made on chromic acid, Washington news, public relations, job evaluation and labor relations. Discussions were held on overtime on overtime, cost of doing business, profit sharing plans, etc. The next meeting is set for March 7, 1949, at Cincinnati, Ohio.

Industry Committee Appointments

The following committee has been appointed by President *Paul H. Henning*, to represent the contract metal finishing industry for the purpose of meeting with government procurement officials in Washington on the government procurement program:

Chairman: *B. M. Baur*, Advance Plating Co., Detroit, Michigan.
Glenn L. Friedt, United Platers, Inc., Detroit, Michigan.
M. G. Herbach, Philadelphia Rust Proof Co., Philadelphia, Pa.
Ralph W. Timberlake, Bar Rusto Plating Corp., Kansas City, Mo.
E. J. Musick, Musick Plating Co., St. Louis, Mo.
Albert W. Olson, Industrial Plating Works, Inc., Seattle, Wash.
Harold E. Coombes, Crown City Plating Co., Pasadena, Calif.
H. Y. Carson, H. Y. Carson Co., Birmingham, Ala.
Wm. F. Walton, Walton & Lonsbury, Attleboro, Mass.
R. A. Campisi, Industrial Enameling Corp., Allston, Mass.
Philip J. Sievering, Philip J. Sievering Inc., New York.
Julian Nelkin, Henry Nelkin, Inc., New York.

Metropolitan Area Job Shop Operations

The October bulletin of the Masters Electroplating Association reports that job shop operations in the New York area have picked up slightly over the

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previous month, but are still below the rate of activity of a year ago. Figures for Oct. 1948 show a rate of operation of 57.5%, compared to 61.5% for a year ago.

The Plating Institute of Michigan

The October meeting was held at the Detroit A.C. on Oct. 13th, with a large attendance. Movies were shown by *George Harding* of the *Harding Mfg. Co.*, of Detroit, on hunting mountain goats and other wild animals in British Columbia and lion hunting in the Rocky Mountains. General discussions were held on "overtime on overtime" and also the increased cost of plating supplies and overhead and how they were affecting prices.

Mr. Paul H. Henning, President of the National Association of Metal Finishers gave a complete report on the Board of Directors meeting held on Oct. 4th in Chicago. The next meeting is scheduled for Nov. 10th.

New President of National Metal Trades Association

Mr. T. J. Morton, Jr., President of the Hoosier-Cardinal Corp., of Evansville, Ind., who was elected to the office of President of the National Metal Trades Association at their 49th Annual Convention held recently at the Commodore Hotel, New York City.

T. J. Morton, Jr.

NEMA to Study Rectifier Standardization

The National Electrical Manufacturers Ass'n, of 155 E. 44th St., New York City, has formed a Metallic Rectifier Section, under the chairmanship of *Mr. C. A. Kotterman*, of Standard Arcturus Co., to study the standardization of terminology, performance, and ratings of metallic rectifiers. *Mr. I. R. Smith*, of Westinghouse, is chairman of the Electroplating Rectifier Standardizing Committee.

AMERICAN CHEMICAL SOCIETY

The crazy-quilt design of metal surfaces is a major factor in rusting, friction, and other destructive processes which shorten the life of metal articles, *Professor Allan T. Gwathmey* of the University of Virginia said at a meeting of the Rhode Island Section of the American Chemical Society, held on October 15th, at Brown University, Providence, R. I.

An ordinary metal surface consists of many tiny crystals in jumbled array, so that a varied assortment of edges, corners, and different faces are exposed, he explained. Recent research indicates that different faces of a single crystal behave like entirely different metals, some rusting much more rapid-

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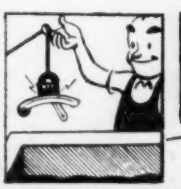

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ly than others, some wearing out faster from friction, Professor Gwathmey reported.

If nature's careless arrangement could somehow be ordered so that each crystal put its best face forward, the usefulness of common metals such as copper, iron, nickel, and silver might be greatly increased, it was suggested.

A new method of study using single giant crystals has been developed at the University of Virginia, according to Professor Gwathmey, who stated that in this way it is possible to measure corrosion, friction, and other properties of a single crystal face. The same measurements carried out on an ordinary metal surface yield nothing more than a sort of average of the properties of all exposed faces, edges and corners.

Striking color patterns have been produced by corrosion of small balls of copper cut from copper crystals, he said, explaining that all possible crystal faces are exposed on spheres of this sort.

Using the colors as an indication of the thickness of the dark coating caused by oxygen, Professor Gwathmey and his associates have calculated that some crystal faces corrode five times as rapidly as others.

Friction between two pieces of copper sliced from large crystals has been found to differ fourfold, depending on the crystal face exposed on the surface and wear between lubricated metal parts varies both with crystal face and with the nature of the gas that makes up the surrounding atmosphere.

The activity of metallic catalysts, such as the specially prepared granules of nickel used to speed conversion of cottonseed oil to vegetable shortening, may be linked to variations in crystal faces, it was pointed out. In one case, the decomposition of carbon monoxide gas on a crystal of nickel, carbon forms so rapidly on some faces that it can subsequently be wiped from the surface with a tissue while no carbon can be detected on other faces with the aid of a microscope. Success in electroplating metal also depends to a large extent on which crystal face is exposed, he stated. When copper is deposited electrolytically on a single crystal of copper from a copper sulfate-sulfuric acid solution at a current density of 2 milliamperes per square centimeter, the metal is deposited more rapidly on some faces than on others and the sphere is converted into a polyhedron at the end of 450 hours.

In the case of corrosion or etching in liquids, one face will be more rapidly attacked than the other. Although this has long been known, as shown by its use in the preparation of metallographic specimens for examination under the microscope, surprisingly little consideration has been given to this important effect in studies of corrosion.

Another interesting effect is the preferred wetting of some faces of copper, nickel, and iron by stearic acid when the crystals are immersed in the liquid and then raised above the level of the liquid and allowed to stand in the air for a few seconds. No such preferred wetting takes place when an atmosphere of hydrogen is maintained above the liquid.

Dr. Parsons Honored

Leading industrialists and educators of the New York area joined in honoring *Dr. Charles Lathrop Parsons*, 81, secretary of the American Chemical Society from 1907 to 1945, at a din-

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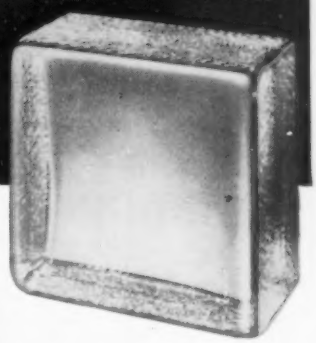

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ner on October 20 at which he was made an honorary member of the American Institute of Chemists. The event was held in the Downtown Athletic Club in New York.

An illuminated scroll, presented to Dr. Parsons at the dinner, acclaimed his services to the profession of chemistry and his contribution to American science, and declared that his tireless efforts had won for him the deep affection and esteem of American chemists. The presentation was made by *Lawrence H. Flett*, president of the Institute, and director of the new products division of the National Aniline Division, Allied Chemical & Dye Corporation.

Dr. Charles L. Parsons

Another speaker, *Dr. Donald B. Keyes* of New York, vice-president in charge of research and development of the Heyden Chemical Corp., said that Dr. Parsons had shown the world "how such a science as chemistry can be organized, not for the direct benefit of chemists only, but for the indirect benefit of all."

Tracing Dr. Parsons' early career as a research worker, as a professor at the University of New Hampshire, and as chief chemist of the United States Bureau of Mines, Dr. Keyes said that at all times Dr. Parsons had been primarily interested in improving the professional status of chemists and that even his research achievements had

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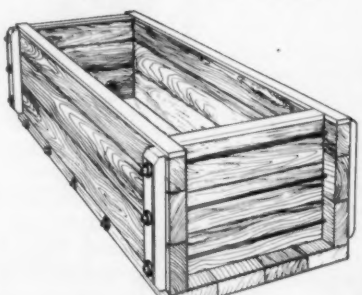
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added to the reputation of chemists as a class. Dr. Parsons, the speaker asserted, is "the chemists' greatest living benefactor."

Dr. Clifford F. Rassweiler, vice-president and director of research of the Johns-Manville Corp. and chairman of the New York Section of the American Chemical Society, also spoke, paying tribute to Dr. Parsons in behalf of the New York Section and also the American Section of the Society of Chemical Industry.

The toastmaster was *Dr. Martin Meyer*, head of the Brooklyn College chemistry department and chairman of the New York Chapter of the American Institute of Chemists. The dinner was sponsored jointly by the New York Chapter of the Institute, the New York Section of the A.C.S., and the American Section of the Society of Chemical Industry.

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News from California

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The new Los Angeles address of the Detrex Corp. is at 625 *South Anderson Street, Los Angeles* 23, *Cal.*

This new, spacious Los Angeles office and warehouse is centrally located to better serve Detrex customers.

The firm also has a solvent manufacturing plant at Tacoma, Wash., and warehouses at 1238 N. W. Glisean St., Portland, Ore., 2431 East Marginal Way, Seattle, Wash., and a branch office and warehouse at 681 Market Street, San Francisco, Cal.

Metalwash Opens California Office

The Metalwash Machinery Corp. takes pleasure in announcing the opening of its new western office located at 1130 *West Olympic Blvd., Los Angeles* 15, *Calif. Mr. J. Sigmund Berlie* will be in charge of this office. Mr. Berlie has had many years of experience in the metal working industries, especially in washing and pickling of metal parts, and is available for consultation and information regarding all types of metal washing, pickling, drying, and processing machinery. This office may be contacted by mail or by telephoning Prospect 5600.

Two veterans of the Southern California silver plating field have contributed their many years experience to the operation of the recently established *V. & J. Silver Plating Co.*, 1016 *South Fair Oaks Avenue, Pasadena.*

Associated in the new firm are *Vernon Gootee* and *Joseph Sunderhaus.* Gootee's career covers extended terms of service with the Boyer & Snyder Co., Los Angeles, and the plating division of National Cash Register Co., Dayton, O. Sunderhaus formerly was head of the plating department of the A. H. Dibbern Co., Glendale, Calif., silversmiths, and previously had directed for a number of years the plating activities of the Olds Band Instrument Co. in Los Angeles.

Their Pasadena shop is equipped with nickel, gold and copper facilities. They specialize in antique silver replating, repairing and cleaning.

Harry Polkras, general manager of Merit Products, Inc., Los Angeles, manufacturers of Sand-O-Flex sanding wheels and abrasive cartridges, reports the appointment of *F. W. Anderson* as company representative for Illinois and Wisconsin. Anderson will maintain offices and demonstration facilities in both Chicago, Ill., and Racine, Wisc. The Merit Co. produces the Sand-O-Flex line of metal and wood finishing tools, including brush-backed sanders designed for finishing irregular shaped and contoured items.

Bachelor ranks of the Southern California plating supply industry suffered another depletion on October 19, which was the wedding day of *Miss Barbara Jean Schipper* of Alhambra, Calif., and *Donald Barber*, president of the Barber-Webb Co., South Gate, Calif., manufacturers of coatings for plating tanks, racks, baskets, drums, and other items. Mr. and Mrs. Barber

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spent their honeymoon in Honolulu, returning to Los Angeles on November 8. In the interim, activities of the Barber-Webb Co. were competently handled by General Manager *Allyn-Webb.*

E. W. and *R. E. Bitticks* of Los Angeles, and *A. C. Kocalis* of San Gabriel, Calif., are associated in the *Atlas Equipment Co.*, which was recently incorporated to engage in the metal plating business.

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NEW BOOKS

Metal Industry Handbook and Directory

Published by Louis Cassier Co., Ltd., Dorset House, Stamford St., London S.E.1, England.

The 1948 edition of this handbook contains much valuable data on the properties of metals and alloys. A complete list of trade names of metals used in England, with their properties, is also included. A section on electroplating, anodizing, galvanizing, and other surface finishes is a valuable part of this manual, as is the very complete directory of English metal working firms and metal supply houses.

Metal Spraying and Sprayed Metal

By *W. E. Ballard.* Published by Charles Griffin & Co., Ltd., London, England. Distributed in the U. S. by *American Metallizing Contractors Association, 773 Brownell Ave., St. Louis 22, Mo.* Third Edition completely rewritten. 6" x 9" cloth bound, 362 pages, 216 illustrations, 61 tables and charts. $10.00 postage paid in U. S.

The author of this book has pioneered the metallizing process and equipment in England and Europe, and he has dealt very competently with all phases of metallizing as well as all commercially used types of equipment, both in theory and practice.

Completely cross-referenced, the book is of value to both operating and engineering personnel as a text book and reference, and it also identifies all authors of published technical papers and articles on the subject of metallizing.

Chapters 9 and 10, dealing respectively with *"The Nature of Sprayed Metal"* and *"The Properties of Sprayed Metal,"* contain a wealth of what appears to be well-authenticated data which has heretofore been either unobtainable or else difficult of access. The entire contents are indexed for instant reference to several hundred subjects.

Much data on the use of metallizing for resistance to many forms of corrosion is ably presented. Because this phase of metallizing has been developed to the point of ready acceptance by design and construction engineers in Great Britain and several European countries, the facts on results after many years in service should be of great interest to those concerned with the adequate protection of structural steel.

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INDEX TO VOLUME 46—METAL FINISHING

JANUARY-DECEMBER, 1948

(Compiled by Mr. Marvin Rubinstein)

With this issue, *Metal Finishing* is inaugurating a new type of yearly index. This index, in which all material which has been published in the monthly editions during 1948 has been listed according to subject matter, with cross references wherever required, will enable the reader to locate all the material on a given subject rapidly and conveniently. We will welcome any suggestions or comments on this new type index.

Early next year we are planning to publish a similar comprehensive index covering all periodicals in the English language that have contained articles on electroplating and allied subjects during the past 10 years.

This new type of index includes not only featured technical articles, but also items that appeared as New Developments, Patents, Shop Problems, Manufacturers Literature, and New Books. Following each listing will be found a letter, indicating the manner in which the reference was published, as follows:

(S)—Shop Problem
(R)—Recent Development
(P)—Patent
(M)—Manufacturers Literature
(B)—New Book

The numbers appearing in the right hand column refer to the month and page numbers; 4-57 means April issue, page 57, etc.

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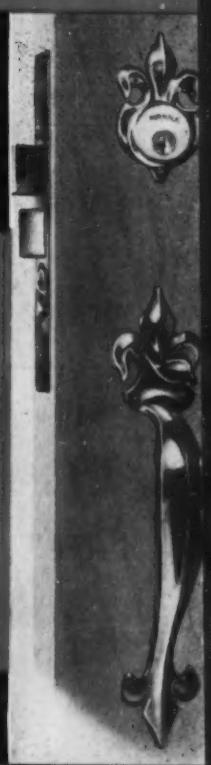

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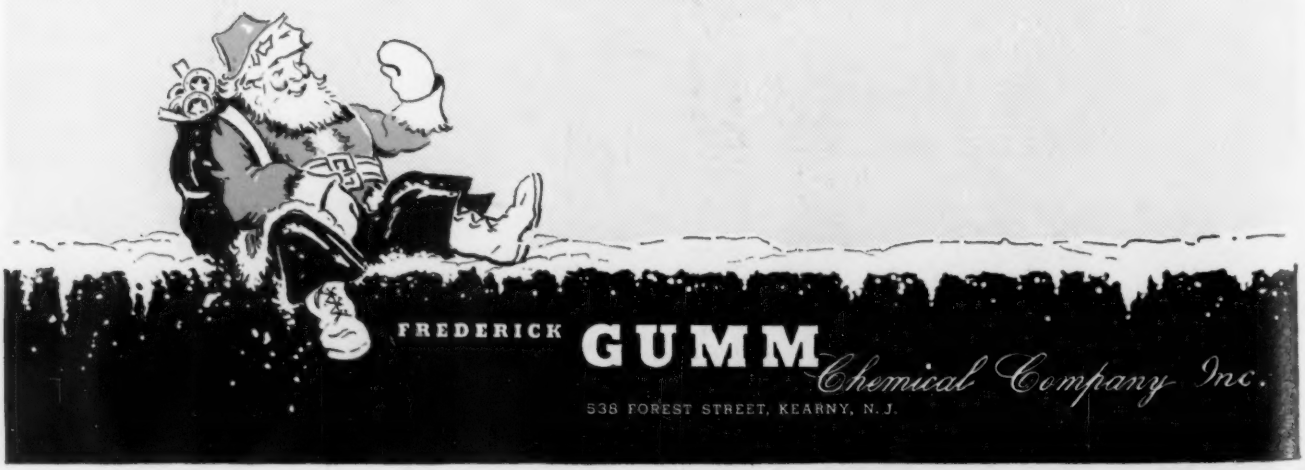

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